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Industrial Arts and Vocational Education

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

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Welcome Back to School

With the 1948 vacation period almost a thing of the past, INDUSTRIAL ARTS AND VOCATIONAL EDUCATION welcomes the shop instructors of America back to their posts. This modern age demands much of those who prepare the young for their future in this age of mechanical, electrical, and chemical wonders.

The task confronting educators is tremendous and requires continuous study, experimentation, adaptation, and cautious change in subject matter and methods, in order that the ever varying requirements of the times be effectively satisfied in the classroom.

To some this may sound ominous and disquieting, but it need not be looked upon in that way. All factors in life are subject to continual change. Our profession does not differ in this from others. We must remain alert and be ready to make adjustments and alterations in our educational offerings whenever that seems necessary. Above all, however, we must observe Alexander Pope's injunction

"Be not the first by whom the new
are tried,
Nor yet the last to lay the old aside."

Almost every important invention is based on the preliminary work done by others. Education also is the result of the thoughts and plans of our predecessors. We must not blindly accept innovations but patiently try out, adapt, and adopt only that which is worthy to be added to the heritage which we have received from the leaders who have preceded us in industrial arts and vocational education.

This Month's Cover

The cover picture chosen for this month's cover of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION portrays radio work as one of the activities in the industrial-arts laboratory at the senior high school at Red Bank, N. J.

The photograph was submitted by Emerson C. Best. It was made by Anthony Trufulo and members of his camera club.

Coming Conventions

Sept. 7–9. American Occupational Therapy Association at New York City. Headquarters, Pennsylvania Hotel. Secretary, Mrs. Lucie Spence Murphy, 1313 E. Elmdale Court, Milwaukee 11, Wis.

Oct. 3. Association of Trade and Technical Administrators of New York State at Lake Placid, N. Y. Secretary, Dr. Edward H. Lane, Smith Technical High School, Syracuse, N. Y.

Oct. 18–22. National Safety Council at Chicago, Ill. Convention chairman, R. L. Forney, 20 N. Wacker Drive, Chicago, Ill.

Oct. 21. Indiana Vocational Association at Indianapolis, Ind. Headquarters, Arsenal Technical School, Indianapolis. Secretary, Glen Barkes, 802 E. Market St., New Albany, Ind.

Oct. 26–29. Virginia Vocation Association at Richmond, Va. Secretary, Robert F. Williams, 401 N. 9th St., Richmond 19, Va.

Oct. 29. Department of Adult Education, N.E.A., at Lafayette, Ind. Headquarters, Purdue Memorial Union. Secretary, Leland P. Bradford, Dept. of Adult Education, N.E.A., 1201 Sixteenth St., N.W., Washington 6, D. C.

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Articles Indexed. — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."

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-IAVE-
SEPTEMBER . . 1948

Developing An Industrial-Arts Program For The Elementary School

DEWEY F. BARICH
Head of Industrial Education
Kent State University
Kent, Ohio

Industrial arts in the elementary schools is accepted with varying degrees of enthusiasm. On the one hand we have some of our professional leaders going on record supporting the philosophy that the entire elementary school curriculum should revolve about the industrial-arts program. On the other extreme, we have those who do not want to have industrial arts in any form below the junior high school level. This wide diversion of opinion probably stems from fundamental differences in the philosophy of elementary school training, and the functions of industrial arts in that area of education. To add to the confusion there seems to be lacking a unanimity among ourselves as to just what constitutes industrial arts in an elementary school curriculum. We even find the lack of common use of terminology, industrial arts, handcraft, craftwork, and construction are just some of the terms picked at random which very often identify the same curriculum area in an elementary school. On the other hand, there appears to be more agreement on the aims and objectives of this segment of the elementary curriculum we shall call industrial arts.

There is almost universal approval of the point of view that industrial arts on the elementary level contributes to general education. Other aims, purposes, or objectives often given include:

1. To develop avocational interests through effective utilization of leisure time.
2. To stimulate purposeful planning resulting in greater levels of achievement.
3. To develop an appreciation of the value of industry to society.
4. To develop habits of investigation, experimentation, and creation.
5. To provide means by which children may satisfy the urge to create and to feel the joy of accomplishment.
6. To develop appreciation of good workmanship.
7. To develop safe work habits.
8. To develop understanding and proper use of tools.

To elaborate on the objectives listed in the foregoing, I quote from a graduate thesis of one of our students.

"Children find real joy and satisfaction in manipulating tools and materials. They are happiest when planning and constructing. Can you imagine a boy doing anything but whistle while he whittles? Did you ever see a boy frown as he pasted the paper on a kite? All of us have seen the utter contentment on the face of a little girl as she patted and smoothed her latest mud pie. Busy hands are happy hands."[1]

Another statement descriptive of the last object is the one by Lewis E. Park, in his article, "Industrial Arts in the Elementary Schools."

"An interesting phase of child life is the expressed admiration of a kindergartner at the net result of his own handiwork, the

[1]Kingzett, A. L., "Handcraft as a Part of the Activity Program."

Group of students in an elementary industrial-arts class. Photographed by Professor Delmar W. Olson, Kent State University, Kent, Ohio

completion of a haggled horsehead conveniently attached to a discarded broom handle, but of greater significance is the psychological effect of successful accomplishment as a motivating influence for further achievement."[2]

It is interesting to note that as early as 1882, manipulative work was introduced as part of the grammar school curriculum. The place was Mont Clair, N. J. This training was given for the express purpose of training the hands to use tools and was called manual training.

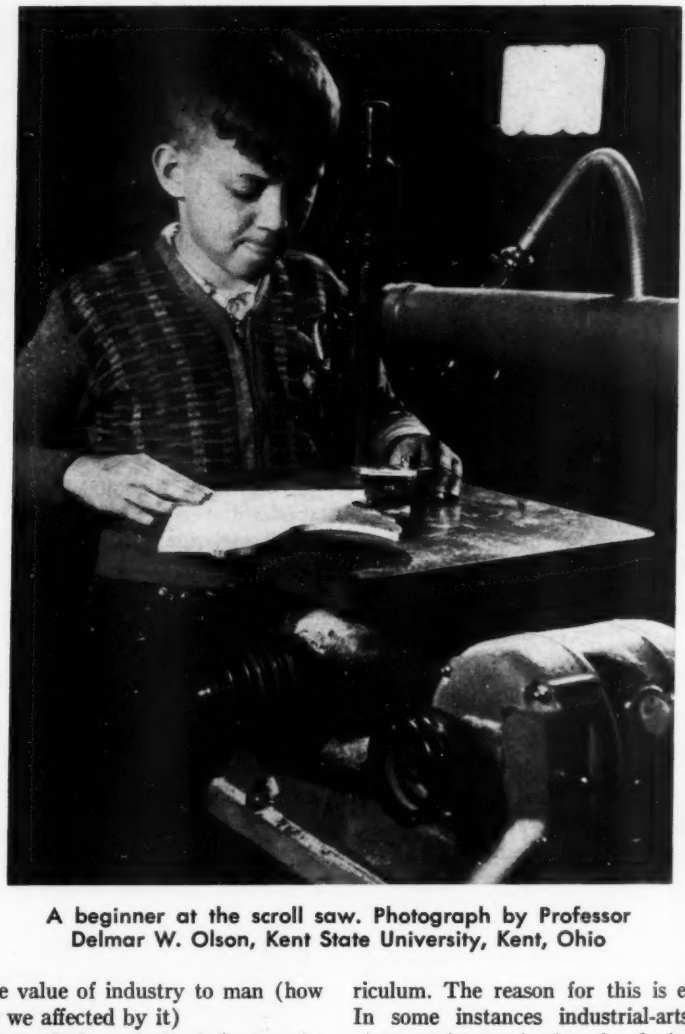
In a book titled *The Industrial Arts in Elementary Education* by Winslow and Gomph, published in 1917, we find an expression of a point of view showing dissatisfaction with the narrow concept of manual training, manual arts, art work and construction. The authors wanted to present a new emphasis on this area of the elementary school curriculum. In doing so they used the then modern term industrial arts and their aim was "a presentation of the study of industrial processes and materials, and all handwork introduced will be chosen with a view of giving familiarity with these materials and to making clearer processes through participation in activities." The approach was to be from the standpoint of general education. "The subject matter was to be chosen from the industries most important to man, the production which may be arranged in the following groups.

I. Stone, clay, and glass products
II. Metals, machinery, and conveyances
III. Wood manufacturers
IV. Furs, leather, and rubber goods
V. Chemicals, oils, and paints
VI. Paper and paper products
VII. Books and printed products
VIII. Textiles and clothing
IX. Foods
X. Water, light, and power

The handwork recommended is based entirely upon the industries studied, and the class is put to work investigating it, and collecting information from all sources available. Much of the material will be obtained through actual contact with those engaged in the industry or those who handle its products. Some facts will have to be obtained from reference books. Students will also be able to collect information by writing to manufacturers whose advertisements they see in magazines and newspapers. The instructor should make assignments covering such topics as the following:

1. The value of industry to man (how are we affected by it)
2. The evolution of the industry: its heroes of invention
3. Characteristics of the product
4. Analysis of the product
5. Materials employed
6. Processes involved
7. Classification of processes as skilled and unskilled
8. Healthfulness
9. Hours and wages
10. Training of the workers
11. The part played in the industry by mathematics
12. The part played by drawing and science
13. References to the industry found in literature
14. The industry as depicted in art

Today we find industrial arts in the elementary school given under three general plans. In small communities and in small elementary schools, industrial arts is taught, when it is taught at all, by the elementary teacher who teaches all parts of the curriculum. The reason for this is economy. In some instances industrial-arts supervisory assistance is given by the industrial-arts teacher in the upper grades. This, however, is the exception rather than the rule. The extent to which industrial arts is taught in such a situation depends on how well the teacher is prepared to carry on the work. Generally speaking, teacher preparation in industrial arts on the elementary level is far behind that of the secondary level. There are teacher-trainer institutions in the country giving this problem special consideration. Some have gone so far as to require certain minimum hours of preparation for *all* elementary teachers. Where the elementary teacher is found to be adequately prepared in industrial arts, it is not difficult to see evidence of it in all phases of activity. A production of a miniature store, post office, fire station, bus, train, or main street calls for a wide range of industrial-arts activities — tools, materials, and plans. A study of birds might bring out the need for feeding stations and birdhouses necessitating considerable industrial-arts activity. In in-



A beginner at the scroll saw. Photograph by Professor Delmar W. Olson, Kent State University, Kent, Ohio

[2] INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Nov., 1946, p. 397.

Trying out the xylophone. Photographed by Professor Delmar W. Olson, Kent State University, Kent, Ohio

stances where the elementary teacher is not adequately prepared, it has been noted that assistance is being asked of teacher-training institutions to provide extension service training. Kent State University, Kent, Ohio, is now engaged in such a service. A member of its staff meets with 15 elementary teachers of several small communities for four periods one evening per week for 12 weeks. Two quarter hours of credit are granted. The classwork is given in a room of one of the elementary schools — the equipment and materials used by the teachers is the same as that used by the elementary pupils. The teachers taking the training are very enthusiastic and the results are very gratifying.

Where such teacher-training service is not available there have been instances where local superintendents or principals with the assistance of the industrial-arts teacher have put on their own elementary industrial-arts program. In some school systems the industrial-arts teacher has been given time in his schedule to work with the elementary teacher in developing her industrial-arts program. There are instances where Parent-Teacher Associations have raised funds by putting on paper drives so that they could buy equipment for elementary industrial-arts programs.

A second plan that is very often used, usually in the small city and country schools, calls for an itinerant industrial-arts teacher for elementary schools. This itinerant teacher spends her time assisting the regular elementary teacher with the industrial-arts phase of her work. Meetings are held where methods, projects, and other problems concerning the elementary industrial-arts program are discussed. The itinerant industrial-arts teacher is one who has adequate training and experience in this field.

A third plan, employed by larger city systems, usually calls for a full-time supervisor, teacher with specialized training, and a special room and equipment. The city of Cleveland, for example, has 80 elementary schools where industrial-arts work is taught by teachers specially trained in the industrial-arts department of Western Reserve University. These specialized teachers teach the fourth, fifth, and sixth graders. Some types of industrial-arts work is taught in kindergarten and grades 1, 2, and 3. However, in these grades the work is taught by the regular classroom teacher.

A unique feature of the Cleveland plan is that the room where the industrial-arts work is carried on resembles a street in a Swiss village. There is a shop or cottage for each activity such as woodcraft, decorative art, metalcraft, ceramic craft, painting and decorating. The textile crafts are carried on at tables. Additional crafts, including beadcraft, linoleum block printing, simple plastics, and leathercraft, also are taught.

Another feature of the Cleveland plan is that the work is augmented with a radio handcraft program. Programs are presented by Radio Station WBOE, the pioneer school station in America. These broadcasts are given each week to 7000 youngsters. While the radio broadcast is going on, each school shows slides, usually colored to assist the pupil in performing their work. The same slide is shown simultaneously in each of the 100 schools. It should be emphasized that the industrial-arts work or elementary handcraft as it is called in Cleveland is closely correlated with art, science, arithmetic, English, and social studies. This program is the result of an experiment that started in 1929 with one craft room in one of the elementary schools. Mr. Hamburger was the teacher. He is now city supervisor of elementary education.

The Detroit schools are also giving attention to this important phase of industrial-arts work. The industrial-arts supervisory staff takes on the responsibility for the work beginning with the fifth-grade level. This program concerns itself with fundamental skills, attitudes, and habits that are common to many types of industrial-arts work, and as the *Teaching Manual* states "the content of the shopwork in the fifth and sixth grade is based on general industrial arts. It has been selected from several activities which include working with wood, metal, leather, and plastics."

There are other industrial-arts activities that might have been included; however, experience has proved that training on this level should begin with tools most frequently used. A suggested list of instructional units include: (1) measure with a rule; (2) saw to a line; (3) trace a pattern; (4) drive and draw nails; (5) whittle with a knife; (6) apply paint; (7) apply wax.

Typical information topics: (1) plan a procedure; (2) grades and uses of sandpaper; (3) uses of brads and nails; (4) lumber; (5) recreation, craft, home workshop, and hobby units.

The Detroit plan calls for the use of pupil-personnel organization. For example, they have a shop superintendent and a foreman for each specific unit. They have a toolman, safety engineer, and record clerk with specific responsibilities for each. Special consideration is given to safety education. Home workshops are encouraged by giving credit for work done at home. The use of salvage materials is stressed.

It appears that there is a great deal of work to be accomplished in developing the industrial-arts program in the elementary schools. Adequate teacher preparation probably heads the list of problems. Then we have the problem of acquainting school administrators and other teachers on how industrial arts is essential to the elementary curriculum. We should not overlook the importance of good public relations, too. There is much to be desired in program development on local, state, and the national level. This is a phase of our work that could well afford the best attention we in the profession can give it.

Opening The School Shop in September

H. A. ALLENDER
Woodwork Instructor
Will Rogers High School
Tulsa, Okla.

A good start at the beginning of school is very essential to the success of the instructor of industrial arts. A college professor of industrial arts once said to a class in teacher training: "I want to be just like the captain of a ship, the first man on and the last man off." A very competent high school principal remarked at the first staff meeting of the year during the week preceding the opening of school: "Your classroom should show a definite evidence that you got there before any of the students arrived." Both of these two educators had the same thing in mind, that of being ready to make a good start at the opening day of school. If the instructor of industrial arts is ready for work when the students arrive his success is very largely assured. If he is not ready when the students arrive, he stands a very poor chance of ever getting ready afterward. He should bear in mind that whether he is ready or not, the students will be ready the first day.

The students should be impressed with two evidences of preparedness on the part of the instructor the first day they see the inside of the shop. First, a shop that is planned and arranged to the last detail, and not even one small item should be out of place. The shop should be just the way the instructor expects to keep it throughout the year when his students come pouring into it for the first time. Second, there should be evidence that the instructor has in mind a carefully thought-out plan for handling classes, issuing supplies, supervising work, etc., and that he knows exactly where he is going.

It is an instructor's obligation to see that every hand tool and every machine in his shop is in top condition when school opens. Later in due time he may delegate a portion of this responsibility to students, but he must do the job himself on the first lap. If he gets started with all physical equipment in good order, he will stand a much better chance of maintaining it that way than he will if he gets started with some of it out of order.

In order to get ready, the instructor is obliged to spend much time in his shop prior to the opening day of school. This often necessitates a sacrifice on the instructor's part, but it will pay dividends later by eliminating trouble and confusion after classwork actually gets under way.

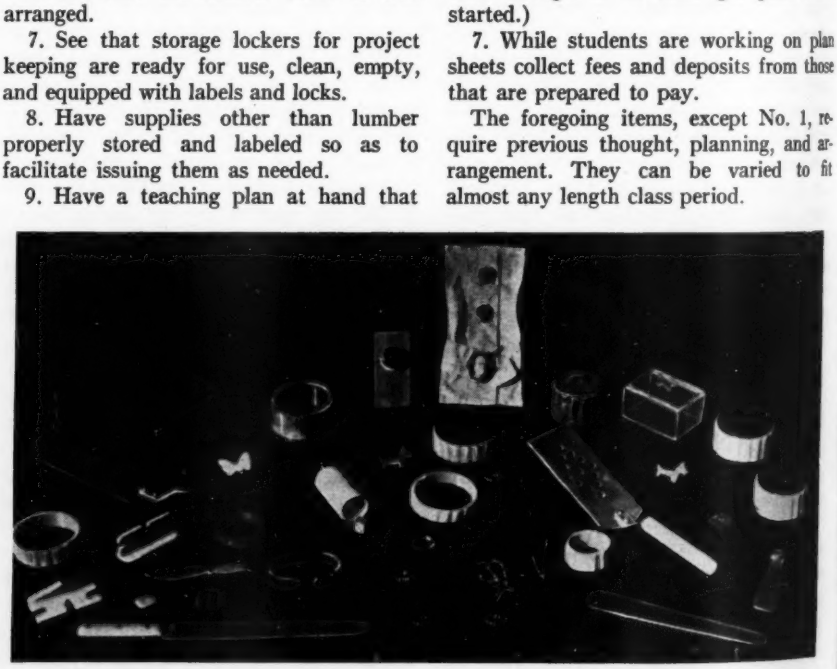
The following is a list of things that should be done before school opens in order to assure a good start by the instructor.

1. Check benches for numbers, loose bolts, and nuts. Bench tops should be refinished each year with gym floor finish.
2. Check vises for worn-out bronze nuts, loose screws, broken handles, sheared pins, etc. Lubricate where necessary.
3. Check all power tools for loose bearings, worn or broken parts, loose screws, bolts, and nuts, adjustments. See that every bearing is properly lubricated, post instructions and safety precautions where necessary. See that no essential part of any machine is missing. See that all knives, saws, and other edge tools are properly sharpened.
4. Check hand tools for adjustments, sharpening, missing parts, loose screws, etc. This applies to planes in particular.
5. See that the tool crib is in first-class condition, clean, all tools on racks, with no empty holes, hooks, or spaces.
6. See that the lumber room is well arranged.
7. See that storage lockers for project keeping are ready for use, clean, empty, and equipped with labels and locks.
8. Have supplies other than lumber properly stored and labeled so as to facilitate issuing them as needed.
9. Have a teaching plan at hand that has been tried. Notes from previous years used in teaching will aid materially.
10. Have a series of project books, conveniently placed, available for use by students.
11. Have a system of record keeping ready to use. This should include class record book, cash receipt book, project plan sheets, student account cards, and refund book.
12. Know what the administration expects of you as a member of the educational staff relative to all school routine.
13. Check supplies ordered and delivered during the summer months.
14. Check equipment against inventory to see that no items have disappeared during the summer months.

Suggested list of first day activities in the industrial-arts shop.

1. Check roll.
2. Explain class organization.
3. Explain plan for handling finances of course.
4. Tour the shop pausing briefly at all points of interest.
5. Explain required work, and mention elective work.
6. Issue project plan sheets and blueprints of first projects. (Allow students time enough to at least get plan sheet started.)
7. While students are working on plan sheets collect fees and deposits from those that are prepared to pay.

The foregoing items, except No. 1, require previous thought, planning, and arrangement. They can be varied to fit almost any length class period.



Group of plastic projects made by boys and girls at Gibbons Road Modern Secondary School, Willesden, N.W. 10, England.
Photograph submitted by P. W. Blandford, Wembley, Middlesex, England.

Teacher Morale

RALPH E. STUCKI
Industrial Education Department
Louisiana State University
Baton Rouge, La.

Teaching is one of the most inspiring professions. It can be kept that way throughout the teacher's lifetime by a definite system of procedure that will provide good mental health.

Teachers are very prone to instruct their classes in the same manner year after year. Certain devices have been found to be good teaching technique. These have been kept and used continuously which has produced a deadening effect on the teacher's initiative, his zest for life, and the high morale he needs for his best teaching. There are many other devices which, if used, would produce more pleasant pupil experiences than the traditional methods used. The course of study cannot be changed to a great extent, but the procedures can be varied. In this way, the need for a morale builder, when everything goes wrong or when teaching seems to be a *blind alley* profession, is practically eliminated.

The following items are not intended as morale builders to which one can turn in an instant nor will they change the morale instantaneously. They will work wonders, however, if a person will apply some of them each year, and they will keep one's morale at a high level, so that there will not be emotional *highs* and *lows*.

These morale builders are not a graded series, classified as one better than another. Those coming first, however, are easier to put into practice than the latter ones.

1. *Change at least one project each year.* The same projects over a period of years make all the work the same old routine. One new project will mean that there will be new planning, different materials to order and many other problems to solve. Nothing grows as stale as making the same things all the time. The pupils like something new. Where there are several children in a family the younger boys have to make the same projects their older brothers made, if the same projects are made year after year. Boys tell the teacher that they know from last year's work which projects will be required for this year. Why not surprise the students once and note the response?

2. *Motivate the work in a different way.* Has each project been graded individually? Why not change to the contract plan where a certain amount of work must be done for each grade? It would be very challenging to a teacher to work out a series of contracts each of value to the student and fulfilling the objectives of the course.

3. *Teach a new unit of work.* A successful teacher should not ignore this means of promoting good morale. We are ever progressing and the industrial-arts teacher must know the newest industrial methods in order to inform his students of such progress. Even in elementary industrial-arts courses there are many new units to teach. These can be either operations or related information. What has been taught about the care of tools? What kind of information is given on occupational guidance? Have the students been informed of the new materials developed in recent years?

4. *Teach in another area of industrial arts than the one to which you are accustomed.* This has so many challenging aspects that a wide-awake teacher could never become bored with himself. Such items as suitable projects, related information, new skills and courses of study will provide the outlet for any emotional strain.

5. *Read at least one professional magazine each month.* Reading the professional magazines will keep a teacher up to date on educational news and the progress being made in the schools. A study of one of the magazines which always has several articles on the progress made by some school system makes a person beam with satisfaction and feel proud that he is a member of such a progressive profession. This is a good way to become acquainted with the leaders in education and the philosophies that they advocate. The magazine articles not only show the trends in education, but also give new methods to use and so help to make better teachers.

6. *Join the professional organizations.* The general organizations; local, state, and national and the industrial education organizations; local, state, and national; have very much to offer to an industrial education teacher. By joining, one becomes a part of that great organized body of teachers and sanctions the principles for which education is fighting. It shows that the teacher is ready to serve when called upon and is paying a share of the expenses. A member of a professional organization is entitled to two other privileges: subscription to the magazine of the organization and attendance at any meeting of the association.

7. *Subscribe to a professional magazine and read it.* To pay out money for a magazine denotes much more interest in the profession than merely reading the magazine at a library. Interesting articles or topics that apply to a particular area can then be cut out and filed for future reference or the copies can be bound into books, in which case a library card system of the articles and projects should be made. Subscription to the magazine assures one of its regular continuance so that a person will keep up to date on modern education. Regular reading in one of the professional magazines is really a gloom chaser.

8. *Attend meetings of the local, state, and national professional organizations.* Here is the place one gets to know his fellow teachers. Here is the place one becomes acquainted with the other fellow's problems and troubles and discovers that no school is without the student troublemaker. It is impossible for most teachers to attend the national association conventions, but nearly all should be able to attend the state or divisional meetings. There is no reason why all teachers should not be present at the local association's discussions.

9. *Attend some school at either the regular or a summer session.* Every teacher is giving while he is teaching. He needs to return to school every few years to replace that which has been taken from him during his teaching career. Regular worth-while sabbatical leave should be taken by every teacher. The contacts made with the teachers and other students help to give him a new outlook on life, that can be obtained in no other way. The worn out feeling a teacher possesses is often the result of always giving but never replacing that which has been drained away.

10. *Write articles for professional magazines.* Do you have a tried and proved method of assembling the class? Do you have some worth-while course outlines? Do you have a definite philosophy of life and education? The ideas of one person are of little value unless shared with others. Personal security and a feeling of satisfaction are the net gains from creating and then knowing that the idea has been accepted by your colleagues.

11. *Be a member of a panel discussion group on the program of the local, state, or national meeting of the professional group.*

Many would disagree with the statement that speaking to a group of associates requires a higher degree of ability than writing for magazines. It is not a better morale builder as each has its own possibilities as a means of achieving satisfaction in a worth-while manner. It does provide a very definite and gradual outlet for any emotional *high* and is, perhaps, the best for that person who is an extrovert.

12. *Be elected to an office in the local, state, or national professional organization.* Yes, it is an honor to be so chosen; for it clearly shows that one's colleagues have confidence in his ability. A person entrusted with such honor must have a personality that shows emotional maturity. This, in turn, was the result of doing some of the less important jobs until that personality had evolved which exuded qualities attributed to a leader.

13. *Obtain a position at another school.* Many times this is the only way open that will give that necessary zest for life needed for dynamic teaching. It does mean that many adjustments will have to be made in order to succeed. While a change of position is not advocated, it is an ideal way to make new friends, increase your personality, broaden your outlook on life, and achieve leadership qualities.

Many teachers must have interests that are not related to teaching if they would keep their serenity and calm poise in the classroom. Some may think that it is only the old-fashioned teachers who do any of the items listed. This is not true; for any teacher interested in his profession and expecting to succeed in it should have more than a passing fancy in some of these undertakings. The majority of teachers do talk *shop* a great deal in their leisure. These are aids whereby a teacher can benefit himself, talk *shop*, and still have a change from the daily teaching schedule. He will be able to keep the personality of a normal individual and not be classed as a *schoolteacher*.

Course Outline For Related Subjects In Plumbing and Steam Fitting

CARLTON DWIGHT
Principal, Vocational School
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The related subjects requirement in all approved apprentice training programs is the basic background for intelligent craftsmanship — competence for practical action. The training of routine mechanics is not enough. To know "how" is important, but competence implies a knowledge of "why" as well.

The primary objective of this course of study is to present the technical knowledge necessary for the apprentice to master in the plumbing and steam-fitting trade if he is to become an all-round skilled mechanic rather than simply an ordinary hand.

The course of study is broad in its coverage of the related subjects field, is not intended to be inflexible, and has been set up on a class of work or unit job basis to meet certain specific training problems. Some of the specific problems which it is felt this type of course organization will best meet are:

1. The training will be of most value to the apprentice if he is acquainted with all phases of related information in relation to a given class of work, rather than attempting to present all of a specific area of related information for the entire trade as courses of study.

2. It is necessary that the related instruction be so organized that apprentices may enter the program at approximately the time they enter the trade. In the plan of organization for this course of study, it will be possible for an apprentice to enter the program at the beginning of any given course. The only prerequisite for any course is the course entitled "Introduction and Basic Information."

This plan, then, makes possible class personnel changes at the beginning of any given course.

The preparation of this course of study was done by the staff of the Division of Vocational Education, Department of Education, Binghamton, N. Y., in co-operation with the Joint Apprenticeship Committee representing the plumbing and steam-fitting trade.

It is not assumed that this course of study is a finished project. It will require constant revision as defects become apparent through its use, and as changes occur within the trade. It does, however, give the teacher a definite starting point, a wide range of material to be covered within specific time limits, and a definite goal to work toward.

Curriculum

Course of Study — One Year Division

Introduction and basic information
Service installation — drainage and ventilation
Water supply piping
Fixture installation
Steam and hot water heating systems installation
Plumbing maintenance and repair
Sprinkler system installation
Ventilation, air conditioning and refrigeration
Lead wiping
Pipe welding
Piping for high and low pressure boilers
Special piping installations
1. Hydraulic power piping
2. Pneumatic piping
3. Industrial process piping

Course of Study

Introduction and Basic Information

This course is basic and it is essential that each apprentice cover this information at the time he enters the program. It will often require individual study on the part of the apprentice under the supervision of and with the assistance of the instructor.

Introduction

A. The plumbing and steam-fitting trade
1. General statement — description of trade
2. Working conditions in the trade
3. Opportunities in the trade
4. Ethics of the trade
5. Qualifications for employment — educational, physical, general

B. The apprentice program
1. The values of the apprentice program
2. Responsibilities of the apprentice

3. The program of related instruction — hours required, subjects covered, where and when the class meets

Basic Information

A. Trade science — materials
   1. Pipe and fittings — kinds, specifications (dimensions and standards), characteristics and uses
      a) Cast iron soil pipe and fittings
      b) Acid-resisting bell and spigot pipe and fittings
      c) Ceramic bell and spigot pipe and fittings
      d) Cast iron screw pipe and fittings
      e) Wrought iron and steel pipe and fittings
      f) Brass screw pipe and fittings
      g) Copper tubing and fittings
      h) Lead pipe
      i) Tin pipe
      j) Noncorrosive lined pipe
      k) Nonmetallic pipe and fittings
      l) Galvanized pipe
      m) Copper bearing pipe
      n) X H pipe
      o) Vitreous tile
      p) Friction caused by burrs in pipe
   2. Supplies—types, specifications, uses, and characteristics
      a) Valves — draw off, relief, pressure relief
      b) Vents and vent fittings
      c) Corporation cocks
      d) Curb cocks
      e) Curb boxes
      f) Traps
      g) Bibbs
      h) Spuds
      i) Faucet packings
      j) Durham fittings
   3. Materials — specifications, uses, characteristics
      a) Oakum
      b) Calking lead
      c) Pipe joint compound
      d) Drain pipe solvents
      e) Litharge
      f) Glycerine
      g) Plumbers soil
      h) Solder
      i) Fluxes, action and preparation — muriatic acid, chloride of zinc, sulphuric acid, rosin, mutton tallow, graphite
      j) Pipe dope
      k) Threading oil
      l) Cement
      m) Putty
      n) Yarn
      o) Petrolatum
      p) Test plugs
      q) Cleats, straps, brackets
      r) Hangers
      s) Pipe covering
   4. Corrosion of metals—causes, effects, and methods of prevention
   5. Pipe thread design, characteristics and specifications
   6. Principles of annealing

B. Trade mathematics
   1. Systems of measure — linear English, angular
   2. Common fractions and mixed numbers — addition, subtraction, multiplication, division
   3. Angles — unit of measure, kinds
   4. Triangles — kinds, formulas and their applications
   5. Circles — definition of terms, formulas and their applications

C. Tools and equipment — types, specifications, uses, and care
   1. Measuring tools — steel tape, spring joint rule, folding rule, framing square
   2. Layout tools — chalk line, straight edge, dividers
   3. Pipe cutters — Barnes, Trimo, Beaver, 3-wheel, 1-wheel
   4. Pipe reamers
   5. Die stocks
   6. Pipe dies
   7. Wrenches — pipe, strap, Parnalee, alligator, chain, speed, adjustable, friction
   8. Pipe tongs
   9. Chain tongs
   10. Bending rack
   11. Tapping machine
   12. Calking iron
   13. Spirit level
   14. Cold chisels
   15. Plumb bob
   16. Hammers
   17. Pipe vise
   18. Trowel
   19. Sewer rods
   20. Sewer cable
   21. Furnace pot and shield
   22. Blowtorch
   23. Ladles
   24. Plumbers' candle
   25. Yarning iron
   26. Files and rasps
   27. Drift plugs
   28. Wiping cloths
   29. Shave hook
   30. Force pump
   31. Pinch bar
   32. Screw drivers
   33. Soldering copper
   34. Hack saw
   35. Bit brace
   36. Auger bits
   37. Twist drills
   38. Closet angles

D. Trade processes
   1. Methods of sharpening tools — chisels, punches
   2. Methods of sharpening bits and drills
   3. How to clean a file
   4. How to file, tin, and forge a soldering copper

E. Safety and accident prevention
   1. Safety rules for the use of hand tools
   2. Safety rules for the use of the furnace pot and blowtorch
   3. Cautions in handling pipe

F. Test and review

Course: Service Installation

Service installation — drainage and ventilation

A. Trade science
   1. Effect of ground and acids on various metals
   2. Electrolysis and methods of prevention
   3. The purpose of stop and waste valves
   4. Cement — chemical action
   5. Principle of expansion and contraction of metals under temperature changes
   6. Principles of vacuum and atmospheric pressure and applications to vent systems
   7. Sewage disposal — municipal system, septic tank, cesspool
   8. Types of venting — individual venting, circuit or loop venting, wet venting, stack venting, grown venting

B. Trade mathematics
   1. Problems in determining pipe capacity
   2. Problems in laying out service installations
   3. Allowance for fittings in cutting pipe
   4. Trade method of figuring amount of materials and supplies
   5. Use of installation guides

C. Special tools, equipment, and materials
   1. Stakes for layout
   2. Pick, shovel, and tile spade
   3. Bending spring or sand, sand plugs and dresser
   4. Cleats and lead tacks
   5. Hangers and increasers

D. Trade processes
   1. Method of determining location and depth of main sewer connection
   2. Method of determining point of outfall of house sewer at building
   3. Method of determining location of stacks, rain-water leaders, and basement fixtures
   4. Method of determining location of connections to house drain from

stacks, rain-water leaders, basement fixtures, and drains
5. Methods of laying out trenches in basement
6. Laying underground sewer — connecting to, cutting soil pipe, laying tile, laying C.I. pipe, making joints (leadite), test for pitch
7. Roughing in drain and ground line — laying pipe, cutting, yarning and calking soil pipe
8. Install waste branches, traps, and vents — lead, cast iron, threaded or screw pipe, miscellaneous (copper tubing, welded)
9. Install rain-water leaders — determining size, expansion joint
10. Install vent flashings

E. Trade information
1. Plumbing laws and regulations — Binghamton plumbing code

F. Blueprint reading and shop sketching
1. The language of industry, lines, signs and symbols, visualization
2. Lines, signs and symbols
3. Essentials of shape description — orthographic projection
4. Essentials of size description — dimensioning
5. Sections
6. Essentials of building construction (architectural) drawings — plans, elevations, sections, and other details
7. Plumbing symbols
8. Problems in reading prints of service installations — drainage and ventilation — determining type of installation, taking off dimensions and materials
9. Essentials of shop sketching — orthographic, pictorial — isometric
10. Making sketches of service installations — drainage and ventilation

G. Safety and accident prevention
1. Safety in the use of tools and materials
a) Support necessary for goose neck
b) Gasoline furnace and hot lead
c) Method of laying soil pipe on board in wet or loose soil
d) Case in pouring leaded joint
e) Case in handling threaded pipe
f) Use sharp wrenches
g) Proper use of threading tools
h) Never use broken tools
2. The use of trench sheathing where soil is loose
3. Safety in the use of scaffolds

Course: Water Supply Piping

Water supply piping

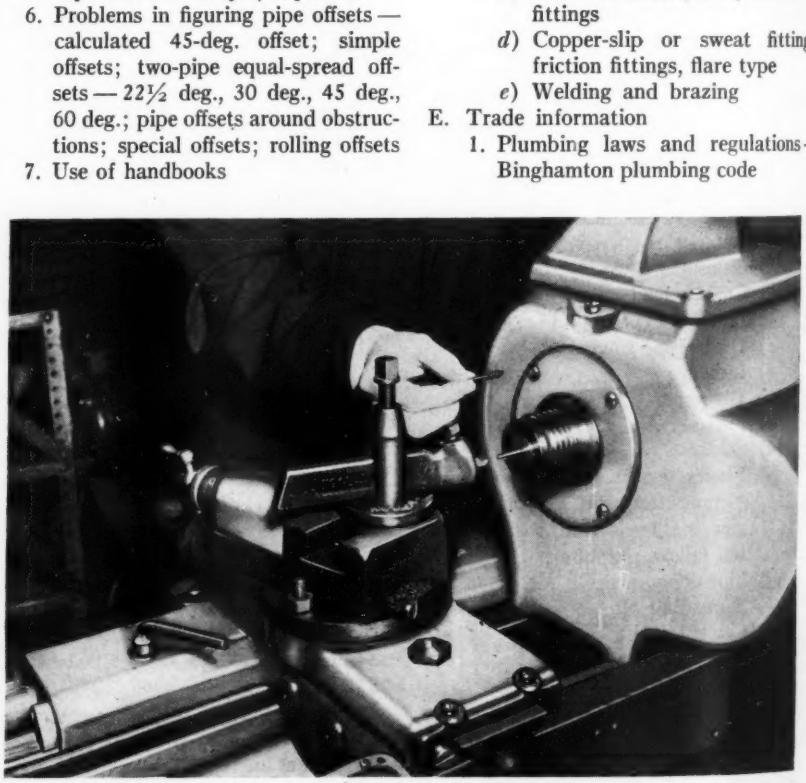
A. Trade science
1. Water — its chemistry and properties
a) Water sources — streams, lakes, ponds; subsurface supplies
b) Municipal water systems — domestic, industrial and commercial, fire prevention
c) Water treatment — purification, softening
d) Water pollution — types of pollution, prevention of pollution
e) Water pressure and regulators
2. Water valves and controls — principles and operation
3. Water hammer — its causes
4. Remedies
5. Frost protection
6. Sweating — its causes and remedies
7. Principles of hot water circulation
8. Friction air lock
9. Siphon principle — back siphonage
10. Water pump principles and operation
11. Testing principles and methods

B. Trade mathematics
1. Problems in figuring allowances for fittings in cutting pipe
2. Problems in determining the proper size of water meter
3. Problems in reading a water meter
4. Problems in determining the amount of pipe and other materials necessary for a given job (bill of material)
5. Pipe bends — simple, expansion
6. Problems in figuring pipe offsets — calculated 45-deg. offset; simple offsets; two-pipe equal-spread offsets — 22½ deg., 30 deg., 45 deg., 60 deg.; pipe offsets around obstructions; special offsets; rolling offsets
7. Use of handbooks

C. Special tools, equipment, and materials
1. Excavating tools
2. Carpenter's tools
3. Water meter

D. Trade processes
1. Service from street main to building
a) Lay out trenching
b) Tap water main
c) Install service from main to curb stop in box
d) Install meter (exterior), install service line from meter to stop and waste inside building wall
e) Install interior meter
f) Install meter box or other protection
g) Test and inspect
h) Back-fill and puddle trenches
2. Establish location of fixtures and hot water tank and heater
3. Establish location of hot and cold water outlets with respect to fixture requirements
4. Bore holes and do necessary cutting
5. Fabricate pipe and fittings
6. Hang, support, and fasten pipe
7. Cap, test, and inspect
8. Cover pipe
9. Pipe assembly
a) Lead-solder nipples, wiped joints
b) Iron-threaded joints, malleable and cast iron fittings
c) Brass-threaded joints, brass fittings
d) Copper-slip or sweat fittings, friction fittings, flare type
e) Welding and brazing

E. Trade information
1. Plumbing laws and regulations — Binghamton plumbing code



13-in. LeBlond regal lathe at American Lava Corp., Chattanooga, Tenn.

F. Blueprint reading and shop sketching
  1. Essentials
    a) Mechanical (machine) drawings
    b) Building construction (architectural) drawings
    c) Plumbing symbols
  2. Problems in reading prints of water supply piping installations
    a) Determining type and location of installation
    b) Taking off dimensions and materials
  3. Essentials of shop sketching
  4. Making sketches of water supply piping installations
G. Safety and accident prevention
  1. Safety in the use of tools and materials
    a) Dangers in using dull tools
    b) Dangers in using mushroomed chisels and calking irons
    c) Meter protection — locate where it will not be likely to freeze; use of check valves in certain instances where backflow might injure meter; stop and waste-cock on each side of meter
    d) Dangers of pipe contacting electric wires
    e) Handling and installing pipe
  2. Safety rules for the use of ladders

Course: Fixture Installation

Fixture Installation

A. Trade science
  1. Fixture materials — cast iron, enameled-vitreous china — solid porcelain
    a) Manufacture of fixtures
    b) Characteristics
    c) Effects of acids
    d) Resistance to chemical action
    e) Cleaning compounds
  2. Definition of an alloy
  3. Fixture materials, monel metal, stainless steel, copper, nickel silver
    a) Manufacture of fixtures
    b) Characteristics
    c) Effects of acids
    d) Resistance to chemical action
    e) Cleaning compounds
  4. Metal plating, chrome or nickel — process, advantages
  5. Corrosion of metals
    a) Ferrous metals (define)
      1) Action of oxygen, acids, and alkalies
      2) Action of electrolysis (define)
      3) Action of heat on cast iron, steel, wrought iron
    b) Nonferrous metals (define)
      1) Action of oxygen, acids, and alkalies on
      2) Action of electrolysis on
      3) Action of heat on lead, zinc, brass, tin, copper, aluminum, nickel
    c) Resistance to corrosion
  6. Siphon principle and application to fixture operation and installation
  7. Capillary attraction principle and applications
  8. Thermostat principle and applications
  9. Valve principles and operation
  10. Testing plumbing systems using water, air, or peppermint
  11. Color combinations related to fixtures
B. Trade mathematics
  1. Problems in locating and roughing-dimensions for fixtures, hangers and fixtures
  2. Problems in leveling, squaring, and plumbing fixtures
  3. Problems in determining allowances for fittings in cutting pipe
  4. Use of handbooks
C. Special tools, equipment, and materials
  1. Special tools — carpenter's tools, hand truck, etc., for handling fixtures
  2. Equipment — types and materials
    a) Fixtures and appliances
      1) Water closets — valve flush, tank flush
      2) Urinals — stall, wall hung, pedestal
      3) Lavatories — wall hung, pedestal, cabinet, leg, waste outlet (all types), plug and stopper, pop-up or mechanical stopper, standing or barrel, water supply (all types), separate faucets, double faucet, combination supply, pedal, knee, elbow valve
      4) Bathtubs — leg type, base type, waste outlet (all types), water supply (all types), built-in types
      5) Shower baths — stall, cabinet, over tub, gang, waste outlet (all types), water supply (all types)
      6) Sinks — kitchen, pantry, wash, slop, chemical and special purposes, laundry tubs, waste outlet (all types)
      7) Drinking fountains — pedestal, wall hung, waste outlet, water supply
      8) Special purpose fixtures
  3. Special materials — backing and supports for fixtures
D. Trade processes
  1. Layout bathroom and kitchen fixtures
    a) Determine waste outlet of fixtures from roughing-in dimensions
    b) Cut holes, chases, and notches
    c) Locate fittings in stack
  2. Install backing and concealed supports for all fixtures and accessories
  3. Install built-in fixtures — set fixtures, connect waste, connect water supplies, anchor supplies, test with water pressure, protect built-in fixtures
  4. Install fixtures
    a) Check rough installation with fixture requirements as to waste and supply connections
    b) Hang and set fixtures
    c) Connect waste trim
    d) Connect water supply trim
    e) Connect hot water heater and tank
    f) Install hose bibbs and sill cocks
    g) Test finished installation
E. Trade information
  1. Plumbing laws and regulations — Binghamton plumbing code
F. Blueprint reading and shop sketching
  1. Essentials
    a) Mechanical (machine) drawings
    b) Building construction (architectural) drawings
    c) Plumbing symbols
  2. Problems in reading prints of fixture installations
    a) Determining type of installation
    b) Taking off dimensions and materials
  3. Essentials of shop sketching
  4. Making sketches of fixture installations
G. Safety and accident prevention
  1. Care in handling and installing fixtures
    a) Securely fasten hangers relative to sink installation
    b) Care in handling chinaware relative to closet installation
    c) How to use wrenches of W.P. surfaces
  2. Safety in the use of tools

(To be continued)

. . . America was created through the magic of transportation. Wheels and keels have made our country great, but wings of global spread shall make it and its influence, for peace and progress, even greater. —*Capt. Eddie Rickenbacker.*

All personnel involved in teaching industrial education should ask themselves these questions, "Am I doing a good job of selling my subject to the public?" "Am I proud of the workmanship exhibited in the projects that my pupils are taking home?" — *W. G. Williams.*

Industrial Arts and Vocational Education

John J. Metz, Editor

THE SCHOOL YEAR 1948–49

Teachers the country over are laying their plans for the first day of school in September. This is very commendable, but it is hoped that the planning is not too narrow for the job that confronts them.

Teachers of industrial arts and vocational education are likely to plan their courses very carefully. Frequently, however, they overlook that much information may be brought into the course which will not take up too much of the student's time, and yet give him a background that will stand him in good stead in his later life, besides adding interest to the work in the school shop.

Take, for instance, the boy who is turning up a candlestick, or making and wiring a reading lamp — would he be interested in reading a brief account of how mankind advanced from the crude attempts at dispelling darkness with burning faggots of resinous wood, or with lamps in which the wick was fed by oil or melting fats, or with the homemade candles of our grandfather's and great-grandfather's day? Would the present-day youngster be interested to know why whale oil ceased to be an important article of commerce after petroleum had been discovered? Or how the kerosene lamp gradually was replaced by gas illumination until Edison's electric lamp gave us a means of banishing the dark which excelled all previous methods that man had tried?

Historical sketches of this kind, well written and illustrated, make interesting bulletin board material for any shop.

Students in the machine shop or metal shop would be equally interested in a short sketch on how iron and steel were made from ancient times to the present. How, in the past, forges were built on windy hillsides so that a forced draft could be obtained cheaply, until it was discovered that preheating the air used as a draft for the blast furnace would hasten the smelting process.

They would also be impressed by facts such as the following: Some rolling mills deliver 2000 running feet of strip steel a minute. The best time for running 600 meters (1968.5 ft.) at present is 1 min. 18.9 sec. The fastest runner, therefore, could not keep up with the piece of steel going through the rolls of that mill.

Recently an iron works in the Pacific northwest found it necessary to cut an ingot mold into two pieces. The walls of this mold were 15 inches thick, and the length of the cut was 12 feet. With a modern water-cooled torch this huge job was finished in 96 minutes.

Many interesting bits of information, like the foregoing, can be found. They will help to make shopwork fascinating to the students, and teachers will find it profitable to keep a lookout for such items, and use them on their bulletin boards, or in their lesson material.

WHY NOT A PRETEST

This issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION will be in the hands of the readers before the schools actually open. It is still permissible then to speak of what to do, on that first day of school, with the students who will be attending shop classes, probably for the first time.

These boys, as they come into your shop, may have a preconceived notion of what they would like to do. Isn't it well to find out from them, what it is they want to do? Knowing or not knowing it may mean much in the student's progress in school, and may even influence his choice of an occupation. Incidentally, also, knowing more about what the students expect from their shop subject may help the teacher direct his teaching emphasis a little better, and in that way enable him to do a better teaching job.

Such a pretest also gives the teacher an opportunity to find out at what level of knowledge his students are when they begin the work in his subject. But, above all, the pretest should give the teacher some inkling as to what a given student intends to do in the way of producing a worth-while example of what he is learning, and, by means of later tests, discover how well he is acquiring the requisite knowledge and skill.

The pretest also may give the teacher a new viewpoint on what his students are interested in. Many of his pupils, of course, will not be able to contribute any suggestions as to the projects which they would like to make. To help these boys, it is well to have at hand numerous thumbnail sketches of things that they can attempt. Looking at these, the student may get ideas of his own.

But do not make the mistake of spending the entire first period on this pretest. The students are anxious to know what your shop has to offer them. Help them get acquainted with it at once. But do not fail to find out from the student what he wants to do, and through this knowledge, make it easier for him to do what you want him to learn and to do.

INTEREST IN SAFETY STEADILY INCREASING

It is quite interesting to note how safety is being emphasized more and more in our daily lives. Federal, state, and municipal units of government are doing their utmost to make everyone more safety conscious in order to reduce the increasing accident toll. Business and industry, too, is doing its utmost to educate their workers to practice safety during every minute of the working day.

To such an extent has this interest in safety practice grown, that at the 36th national safety congress and exposition, to be held by the National Safety Council in Chicago from October 18 through October 22, 1948, five leading hotels had to be chosen to house the safety sessions and expositions. The industrial safety exposition and industrial sessions will be held at the Stevens Hotel; public safety exposition and traffic, farm, home, and women's safety sessions at the Sherman; industrial and school and college sessions at the Morrison Hotel; and the industrial sessions at the Congress and LaSalle Hotels.

All of this is very heartening, but in spite of this emphasis and activity in the field of safety, there are still too many school shops where the subject of safety is touched upon only perfunctorily and at uncertain intervals.

Safety, however, deserves to be stressed in every shop class. The teaching of safety should be carefully planned. If you have been lax in your safety work in the past, make a real attempt at correcting the omission in the new school year.

Plan to give some safety instruction every day. Have your shop safe; do your own work safely; preach, exhort, and teach safety.

Some Leaders in Industrial Education

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(*Continued from page 224 of the June, 1948, issue*)

Lorenzo Dow Harvey

The subject chosen for this sketch is especially worthy of a place in this series because of his versatility as an educational leader. He is best known, at least to the present generation, for his contribution to the professional preparation of teachers of industrial arts and homemaking. Nevertheless, if he had done nothing in this field, his accomplishments in other directions would have insured a place for him in the educational hall of fame.

His career included service as principal of a high school, city superintendent of schools, member of the faculty of a state normal school, president of a state normal school, state superintendent of public instruction, president of The Stout Institute, and withal an influential public advocate of educational progress, and an outstanding state and national leader in professional organizations of educators. In all these varied activities, almost from the very beginning of his career, his thorough study and analysis of the tasks assigned him, his devotion to duty, his common sense and practical measures for the solution of educational problems, his organizing ability, and the endearing qualities of an attractive personality, won the attention and admiration of students, teachers, members of the board of regents and of the state legislature, other associates, and the general public who came to know him.

My first meeting with Dr. Harvey was at the annual convention of the old Western Drawing and Manual Training Association, which met in Milwaukee, Wis., in May, 1904. This was also my first attendance at a meeting of this Association. Dr. Harvey became head of the Stout Training Schools, as they were called at that time, in the fall of 1903, the same year in which I began my work at Illinois State Normal University, Normal. I do not remember at all what part he had on the program, nor anything of what he said. But I do recall my impression that I was listening to a man of outstanding character, poise, and authority. It was my privilege to meet him later in other moods, but at that convention I remember him for his discussion of the topic assigned him, which, I have no doubt, had something to do with the importance of industrial-arts teachers making adequate preparation for their work.

The Chicago Convention

The next meeting with Dr. Harvey of which I have any tangible recollection was at the second annual convention of the old National Society for the Promotion of Industrial Education, which was held in the Auditorium Hotel, Chicago, January 23–25, 1908. That was an historic convention, but I must not allow myself to get off the subject.

I find that I preserved a memorandum of an extract from Dr. Harvey's address at that meeting on the subject, "The true ideal of a public school system that aims to benefit all." I suppose the reason why his address made such an impression on me was that, as a young teacher, I was in the early stages of trying, more or less unconsciously perhaps, to formulate a philosophy of education — though I am sure I was not calling it by that high-sounding name. With only a few years of teaching experience, and with what I myself recognized at the time as inadequate preparation, I was made head of a department in the Illinois State Normal University, and assigned the task of showing or telling other young people how to teach. I was in the position of needing and wanting to know what education is all about.

Here is one of the passages in Dr. Harvey's address that remained with me for a long time: "The elementary and high schools should not be diverted from the best educational service of the majority of those who attend them in favor of preparation of pupils for college entrance. . . . The high schools are maintained by the people for the people and not for the colleges. . . .

Lorenzo Dow Harvey

At one time the needs of a majority of those attending high school was preparation for college, but that is no longer the case, for a large majority of those who attend high school never go to college." During the years that have elapsed since that convention, hundreds of educational "leaders" have given lip service to the doctrine then enunciated, but the fact that after 40 years so much remains to be done to make it fully effective is sufficient to explain and to justify the earnestness with which the speaker delivered his message.

My first visit to The Stout Institute was in May, 1910, one of the years in which the Western Arts Association held a convention in Minneapolis. I decided to go early and spend one day in Menomonie. On the train from Chicago were others bent on the same mission, and I believe there were four men in our party when we were ushered into President Harvey's office. He imme-

diately sent for George F. Buxton, then head of the industrial-arts department. He then called someone on the telephone to say that he would have some guests for luncheon. We had a conference of a half hour or so in which Dr. Harvey gave us a brief account of the founding of the Institute, a statement of objectives, and an outline of the plan of organization.

As Professor Buxton started out with us on a tour of inspection, Dr. Harvey said: "George, you know what to show these gentlemen, and what to keep them out of — and we'll meet again for luncheon at 12:30."

I made three subsequent visits to The Stout Institute, one of which was for a period of one week during the summer session of 1917, at which time I conducted a series of conferences twice daily on problems of the industrial-arts teacher and current developments in vocational education.

Early Life

Lorenzo Dow Harvey was born November 23, 1848, at Deerfield, N. H., and died at his home in Menomonie, Wis., June 1, 1922, after an illness of more than a year.

His parents moved to Wisconsin in 1850 when he was only two years of age, and settled on a farm in Rock County. Here he attended a district school during the winter months, walking two miles. He was remembered as a good pupil, excelling in English and arithmetic, and usually victorious in spelling matches. He began early to carry his share of work on the farm, and at one time, while only 12 years of age, carried the entire responsibility of the home farm for several months during a severe illness of his father.

In 1864, at the age of 16, he passed the county superintendent's examination for a third-grade certificate and during the winter months for the next four years taught a one-room country school. Some of the boys were larger and older than he, and occasionally there were indications of incipient trouble. Even at this early age he displayed the necessary qualities of leadership and considerable tact in dealing with those who seemed disposed to be unruly. He secured the respect of his boys by his proverbial good nature, his willingness to recognize good qualities even in the would-be bad boys, and in occasional feats of strength.

During the years he was teaching school in the winter months, he attended near-by Milton College in the early fall and spring. In this way he completed two years of college work, making an excellent record.

In 1869 he conducted a private school in Walworth County. The following year the president of Milton College offered him a position as part-time teacher of mathematics, and he returned to finish his college course. He was graduated in June, 1872, as valedictorian of his class.

High School Principal

In the fall of 1872 he became principal of the high school at Mazomanie, Wis., where he remained two years. In 1874 he was appointed principal of the high school at Sheboygan. It was here that he began to attract attention as an instructor and organizer.

While at Sheboygan he spent his evenings studying law and in 1877 he passed the examination and was admitted to the bar. He was also promoted to the position of superintenndent of schools. The extra work began to tell on his health, and in 1880 he entered into a partnership with a friend in the business of bottling and shipping mineral water. However, at the request of the board of education, he retained his position as superintendent of schools.

While engaged in the mineral water business he invented a bottle wrapping machine, and secured a patent on it, which he later disposed of. The man who took over the patent realized a small fortune on it in the course of a few years.

Conductor of Teachers Institutes

In 1885, having decided that his future lifework was to be in education rather than in the law or in the bottling business, he accepted a position as state institute conductor on the faculty of the State Normal School, at Oshkosh. In this work he quickly made a place for himself as one of the most popular teachers in the school. For the next seven years he spent nearly every week end and most of the summer months conducting teachers' institutes. He was very successful in this work, for he gave evidence of being a master teacher himself, and he made it a point to study the strong and weak points of his students in order to be of the greatest possible assistance to them in their work.

Normal School President

In 1892, Mr. Harvey was invited to become president of the state normal school in Milwaukee. The board of regents decided to organize this school, opened in 1885, on a basis different from that of the other normal schools in Wisconsin. From the beginning the Milwaukee Normal School admitted only graduates of four-year high schools, whereas the other normal schools made provision for students who had not completed high school.

The curriculum of the Milwaukee Normal School was two years in length, and originally three fourths of the time was devoted to professional work. However, by the time Mr. Harvey became president the curriculum had been materially changed by reducing the amount of professional work and increasing the proportion of academic studies. At least one of the reasons for these changes was said to be the influence of the universities which were unwilling to permit graduates of the two-year normal school curriculum to complete the requirements for the baccalaureate degree in two additional years because of the disproportionate number of credits in professional work.

Another problem confronting the new president was the qualifications of the members of the faculty, most of whom had had little or no teaching experience in the elementary schools for which the normal school was supposed to be preparing teachers. Members of the faculty had been chosen in most instances because of their academic attainments. To a considerable degree they conceived themselves as teachers of the various subjects for which they were appointed rather than as teachers of prospective teachers. It is significant that Mr. Harvey recognized this as one of the major problems demanding attention. "Possibly the most important work Mr. Harvey did during the first year of his presidency was to impress upon the members of his faculty his ideals of what a normal school should be, and that the subject matter and the methods of instruction should be adapted primarily for the purpose of contributing to the future teaching ability of the students."

During his presidency he made a point of becoming personally acquainted with the students. Besides teaching one hour each day and conducting a daily assembly period, he held many individual conferences with students to discuss their work. In this way he was able to judge the type of position each was best qualified to fill after graduation. Assuming responsibility for the placement of graduates he conducted an extensive correspondence course and made many personal contacts with superintendents, principals, and school trustees. Soliciting the opinions of these school officials on the problems and needs of the schools, he formulated definite ideals as to the function of the normal school in meeting the needs of the state for trained teachers. "He believed thoroughly in the idea that the normal school is essentially vocational in character."

Practice Teaching

Mr. Harvey early came to the conclusion that something needed to be done to improve the conditions under which practice teaching was carried on. Because of small classes, restricted personnel, type of organization and daily schedule, and for other reasons, conditions in the training school were not typical of the conditions which graduates must face when they went out to teach in the public schools. "One of the most important things he accomplished during the early years of his presidency was to induce the Milwaukee board of education to pass a resolution authorizing him to use certain public schools of the city as practice schools." Without precedents to guide him, he was obliged to solve a number of problems, among them the inevitable suspicion that the normal school intended in some way to dominate the local public school system. It was soon discovered that co-operation between the normal school and the public schools was decidedly advantageous to both. Beginning in 1895, every graduate was given opportunity to do some practice teaching both in the training school and in a public school, under the supervision of a member of the normal school faculty and of one of the regular classroom teachers of the city schools.

As time went on, Mr. Harvey gradually carried over to members of his faculty the conviction that the normal school should be, primarily, a vocational school. As the school grew and new teachers were to be added, he selected only those who had had recent experience in teaching either in elementary or high schools. He endeavored to persuade the members of the faculty that their own classroom methods had more to do with fixing the teaching ideals of students than formal lectures on methods and theories of education.

Four Fundamentals of Instruction

Mr. Harvey's work with the faculty of the Milwaukee Normal School, and his efforts to improve the quality and effectiveness of the teaching function, resulted in the formulation of his concept of the four fundamentals of instruction. These four fundamentals had been used previously by Harvey in his teaching, and were probably not even original with him. They had been used, consciously or unconsciously, by good teachers for many years. But, because of the publicity given them during Harvey's presidency of the Milwaukee Normal School, and later, in faculty meetings, in teachers' institutes, in educational conventions, and elsewhere, they became almost as well known as the "five formal steps" of the Herbartian philosophy. Following is a summary of the four fundamentals:

1. Before engaging in any teaching exercise the teacher should have a definite aim or purpose to be realized.
2. The teacher must have in mind the things which the pupils must know or do in order that the purpose or purposes may be realized.
3. The teacher must determine what of the things falling under paragraph 2 the pupils now know or can do.
4. The teacher must determine, among the things to be learned or done, the order in which they are to be taken up by the pupils, and how.

It should be noted that phrases somewhat similar to these were given wide currency three or four decades later by Robert W. Selvidge, who insisted that before effective learning can take place it must be determined "what the pupil must know and what he must be able to do" in order to accomplish the task set before him.

Harvey further elaborated these fundamentals by urging that in conducting a recitation it is necessary to determine what is to be done by the pupils and what by the teacher, and how. The pupils' work before the recitation should be preparation of work assigned, and the recitation should show the quality and extent of work accomplished through expression in one form or another. Inadequate preparation should be supplemented by further work under the direction and inspiration of the teacher, through teaching. "It is important to emphasize the necessity of the teacher's determination of the various elements of knowing and doing involved in the statement of *what* is to be known and done. Failure to recognize the fundamental character of this specific phase of teaching has resulted in the overcrowding of courses of study with material that is irrelevant or nonessential."

One of the most significant functions of teaching is in the assignment of work to be done by the learner, either during the present recitation period, or in preparation for the next recitation period. "Not only must the teacher know what the learner is to do next and consequently what specific preparation he must make for it, if advanced preparation is possible, but the learner must be made conscious of what is expected of him in his preparation and in his doing of assigned work. This means that the teacher must give much more time than is usually given in assignments, to assure a very definite understanding on the part of the learner as to what the preparatory work is, and what will be expected of him."

It was emphasized, in season and out, that these fundamentals apply equally well to textbook work and to handwork, drawing, music, shop, or laboratory work. They apply in the kindergarten, in the primary grades, in the upper grades — indeed in any level or phase of teaching in which the teacher has in mind any definite thing which he expects the pupil, because of his teaching, to know or to be able to do.

(To be continued)

English For Trade and Vocational Schools

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Adjectives and Adverbs — Part II

(Part I was published on page 7 of the January, 1948, issue)

Less important than the junior class spelling unit, Part I, but worth some attention is the unit on adjectives and adverbs for seniors. Each boy is required to understand, remember, and be able to use correctly in drill work the following simple rule: "Use an adjective with a no-action verb, an adverb with an action verb." He also learns to use a few difficult adjectives and adverbs which are often confused in boys' written work: *sure — surely; real — very; good — well; most — almost.*

The instructor should spend a few minutes at the board, pointing out the difference between an adjective and an adverb, and illustrating linking (no-action) verbs and action verbs. Even average students are able to learn swiftly how to use *an –ly word with a verb that shows action.* Drill exercises will then fix their use more firmly in their memory. The following chart can be used to introduce this instruction:

ADJECTIVES AND ADVERBS

An *adjective* tells about a noun or pronoun.

	Adjectives	*Nouns*
A	*new*	chisel
A	*sharp*	blade
A	*red*	car
Pronouns	*Linking Verbs*	*Adjectives*
He	was	*sick*
She	is	*pretty*
It	was	*dull*

With a *linking* ("no-action") *verb*, use an adjective.

An *adverb* tells about a verb, an adjective, or an adverb.

He fights *skillfully*.
(*action verb*) (*adverb*)

Tom is too *sick* to go to work.
(*adverb*) (*adj.*)

She jumped *very* quickly.
(*adverb*) (*adverb*)

Adverbs usually, but not always, end in *–ly*.
(*adverb*) (*adv.*) (*adv.*)

With a verb that shows *action*, use an *adverb* (an *–ly* word).

Examples of linking verbs ("no-action verbs"), such as ***is, are, was, were, feel, look, taste, seem, sound, smell, become, appear*** are put on the board and used in sentences ***with adjectives;*** then examples of action verbs (***fight, repair, work,*** etc.) are used in sentences ***with adverbs*** (***–ly*** words). The members of the class make up the sentences to be discussed. This preliminary instruction continues until the instructor feels that everyone in the group has had a fair chance to learn this much.

For further drill work, which in my school is done on a strictly individual basis, one student at a time, practice sentences from grammar books and workbooks can be used; or the instructor can make his own work sheets and have them mimeographed or printed for class use. I prefer to make my own so that the sentences will be simpler and less academic than those often found in texts and workbooks; for example, here is one block of a typical drill sheet containing six blocks of sentences of this sort:

1. The pitcher threw the ball (swift — swiftly). 2. (Most — almost) every day we hear the big guns firing at the fort. 3. I feel (bad — badly) about this mistake. 4. She had a (real — very) good speech. 5. He (sure — surely) did a good job on that old Ford. 6. They worked their problems (accurate — accurately). 7. Your car runs (good — well). 8. He speaks fast and (careless — carelessly) most of the time. 9. The football field was very (smooth — smoothly) when the game started. 10. I worked on the model (steady — steadily) for a month.

In addition to the main rule (adjective with no-action verb — adverb with action verb), students need to be helped to use correctly the adverbs *well* and *almost* and the adjectives *sure* and *real*. Because they hear the adjectives *good* and *most* used for *well* and *almost*, and because *sure* and *real* are almost invariably used instead of the corresponding adverbs, most American boys use the wrong forms as a matter of course. The instructor cannot expect to stop these errors in the spoken English of his students, but he can show them how to use the correct forms in their written work. To help accomplish this the following charts will be found useful:

SURE: CERTAIN — SURELY: CERTAINLY

The word *sure* is almost always used incorrectly. Before you use it in a sentence, try using the words *certain* and *certainly*.

If *certainly* belongs in the sentence, use it instead of *sure*.

If *certain* belongs in the sentence, use either *sure* or *certain*.

An easy way to avoid mistakes in the use of *sure* is to use *certain* or *certainly* instead of *sure* and *surely*.

REAL: GENUINE

The word *real* means *genuine* (not artificial).

Examples:

A real wool sweater (a genuine wool sweater)
Real antiques (not *fake* or imitation)
Real Italian briar (not artificial briar)

Whenever you are in doubt about using the word *real*, try using the word *genuine* in its place. If it fits, use either *real* or *genuine*.

The word *real* is frequently used instead of the word *very*.

Examples:

It was a real good repair job.
(better: very good repair job)
We saw a real interesting picture.
(better: very interesting)

Notice that the word *genuine* does not fit properly into either of these sentences. When *genuine* does not fit, try using *very*.

MOST — ALMOST

The adverb *almost* means *nearly*.

Examples:

Almost (nearly) every boy has finished his work.
Almost (nearly) every man has left the hall.
Almost (nearly) every dog on the plantation is trained well.

Most is often used instead of *almost* because it sounds exactly like the contracted form of *almost* ('most).

Most means *the majority*.

Examples:

Most (the majority) of the tools are rusty.
Most (the majority) of the boys have summer jobs.
Most (the majority) of the young were employed.

GOOD — WELL

Good is an adjective.

Well is sometimes an adjective, sometimes an adverb. When *well* is an adjective, it is usually used correctly.

The adjective *good* should not be used instead of the adverb *well*.

Usually *well* is an *adverb* and should be used with an *action verb*.

Examples:

The car's engine runs well now.
A.V. Adv.
(*not* runs good)

That salesman talks well.
A.V. Adv.
(*not* talks good)

Our team played well last night.
A.V. Adv.
(*not* played good)

With a minimum of class instruction and a great deal of patience, the combination of charts and drill sheets will enable students to use correctly the main rule (no-action verb, adjective — action verb, adverb) and the difficult words just explained. There will be practically no change in the spoken English used outside of school, but written work will improve noticeably. Later, as adults, if graduates become genuinely interested in speaking correctly, they will at least know how to use adjectives and adverbs correctly.

(*To be continued*)

Our entire educational system needs a thorough overhauling. . . . Steps must be taken to improve the living conditions of all teachers and the facilities of all branches of education — from one-room rural schools to our great universities.— *Capt. Eddie Rickenbacker.*

Shop Bookkeeping System

NAIDENE GOY
Hinsdale Township High School
Hinsdale, Ill.

Any kind of shop bookkeeping system should meet these three standards: (1) It should be simple so as not to tie up too much of the shop instructor's time. (2) It should show individual student transactions in order that each may be traced with a reasonable degree of thoroughness. (3) It should be reasonably "foolproof" so that a part-time reliable student employee may assist in keeping the records. A system which meets all these qualifications is in operation at Hinsdale Township High School.

The bookkeeping setup involves the use of but six kinds of business record forms:

No. _____ _____ 19___

Received of _____

_____ Dollars

_____

Amount Paid $_____

Balance Due $_____ _____

Acivity fund receipt form

1. *Duplicate Receipt Book* — No money is accepted or a cash refund made by the shop instructor without the issuance of a receipt. The payer receives the original and the carbon is kept in the receipt book.

2. *Purchase Cards* — issued in the amounts of 50 cents, $1, $1.50, and $2. Each purchase card is numbered and this number is recorded on the carbon in the duplicate receipt book. In turn, the number of the carbon in the duplicate receipt book is recorded on the purchase card. The purchase card corresponds to the cash deposit made at a bank and which is recorded in a bank passbook. It represents an amount against which the student may draw for materials for his projects. No student may overdraw on his purchase card. Amounts are canceled in ink by the industrial-arts instructor as the stock cards are filed.

3. *Stock Cards* — filled out by the student himself for each shop project. The cost of any project cannot exceed the *bank balance* as represented by the purchase cards of the individual student.

4. *Requisition Slips* — order forms made out by the shop instructor for materials to be used for resale for student projects. These are kept in a file in numerical order.

5. *Activity Fund Cash Receipts* — issued by the central accounting system of the school office whenever cash is deposited by the shop instructor. These are filed by date. The total of the cash receipts equals the total recorded in the duplicate receipt book less the total cash refunds made.

6. *Annual Financial Statement* — made to the board of education. A record of the total purchases and total sales for the school year, including schedules of the salable supply inventory at the end of the school year, of materials taken from shop supplies for the use of school activities and projects in other departments, of the net cash collected and deposited in the central accounting office, of the total cash refunds made and of the total cash sales as represented by purchase cards on hand.

HINSDALE TOWNSHIP HIGH SCHOOL
GENERAL FUND

No. 1650

Date _____

The GENERAL FUND has received $_____ from _____

_____

representing _____
(Name of Organization)

to be deposited to the credit of this organization.

Received by:

_____

(Original copy to organization, duplicate to office.)

Duplicate cash receipt form 8½ x 6 in.

R.—No. ..... No. 1088
Students Name .....
Grade ..... Period .....
INDUSTRIAL ARTS
PURCHASE CARD
$.50

R.—No. ..... No. 1845
Students Name .....
Grade ..... Period .....
INDUSTRIAL ARTS
PURCHASE CARD
$1.00

R.—No. ..... No. 1696
Students Name .....
Grade ..... Period .....
INDUSTRIAL ARTS
PURCHASE CARD
$1.50

R.—No. _____ No. 2285
Students Name _____
Grade _____ Period _____
INDUSTRIAL ARTS
PURCHASE CARD
$2.00

3 by 5-in. purchase cards

STOCK CARD
INDUSTRIAL ARTS Grade Period
Student's Name Date

No. of Pieces	SIZE AND KIND OF MATERIAL	Amt.	Price per Unit	Cost

Name of Project Total Cost $
Approved Date Started Date Finished

3 by 5-in. stock card

The financial statement lists totals and is not a detailed statement since each individual transaction is not shown. However, all individual records are kept in the files and each may be checked at any time.

Originator of the shop accounting system in Hinsdale is the industrial-arts instructor, H. F. McKee, who devotes no more than two hours a week to keeping the accounts for 150 boys whose small transactions for shop projects approximate eleven hundred dollars each year.

To prevent loss of time for needless checking back of accounts for individual students, a service charge of 10 cents is made if the student has made a mistake in requesting an auditing of his account. If the instructor has made a mistake in auditing an individual account, the student is credited with 10 cents. This device has eliminated the problem of unnecessary account checking; however, any student may have his account completely checked up to September 1 following the current school year.

HINSDALE TOWNSHIP HIGH SCHOOL
Board of Education District 86
PURCHASE REQUISITION
№ 115
P.O. No.

THE GOODS OR SERVICES LISTED BELOW ARE REQUIRED FOR THE DEPARTMENT OR ACTIVITY.
Date
REASON OR NEED FOR PURCHASE:
I RECOMMEND THAT PURCHASE BE MADE FROM:
(Give Exact Name and Address)
CHARGE ACCT. NO.

NOTE: THIS IS NOT A PURCHASE ORDER—DO NOT SELL ON THIS REQUISITION

QUANTITY	DESCRIPTION	UNIT PRICE	AMOUNT

Requisitioned by Approved

Purchase requisition 8½ by 7 in.

Equipment needed for such an accounting system includes a filing cabinet of six drawers for 3 by 5 cards. The drawers are labeled as follows:

Drawer 1 — Active Purchase Cards
Drawer 2 — Expired Purchase Cards
Drawers 3, 4, 5, and 6 — canceled stock cards for the current year filed alphabetically by names of students: A–F, G–K, L–R, S–Z.

Such skillful business management as used in the industrial-arts department of the Hinsdale School adds to the promotion of efficiency since it gives the instructor, the students, the administration, and the board of education complete protection.

Teaching Materials For Industrial Education

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Agricultural and Mechanical College of Texas
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(Continued from page 230 of the June, 1948, issue)

FILMS

The following list of teaching aids was collated to help the teachers of the various departments of industrial arts and vocational education.

It is advisable for teachers or individuals to use school or letterhead stationery when writing for any of the films listed. Films should be ordered well in advance; several weeks' notice is desirable. In ordering films it is best to mention a second and third choice in case the first selection cannot be furnished when desired; also alternate dates.

The rental price for one day is listed if the film is not a free loan. Where a loan fee is requested, that fee should be included with the order to save time and correspondence concerning this. Transportation charges must be met in every case. The borrower is required to pay any loss or damage done to the films in his possession.

The following points are helpful to remember in ordering and handling films:

1. Order several weeks in advance.
2. Give second and third choices.
3. Give the desired date of showing the film.
4. Specify an alternate date of showing if possible.
5. Specify the size of the film, i.e., 16 millimeter or 35 millimeter.
6. Return the film the next day after showing.
7. *Do not rewind* the film unless advised to do so.
8. Do not damage it or handle carelessly.
9. Run 16mm. sound print on a 16mm. sound projector *only*.
10. Include the loan fee with your re-

quest, if you know what it is. This saves time and correspondence.

Drafting

Wisconsin, University of, Bureau of Visual Education, University Extension Division, Madison 6, Wis.
Angles — 12 min. — sound (rental) — $1.25
Locus — 11 min. — sound (rental) — $1.25

Electrical and Communications

United States Department of the Interior, Bureau of Mines, 4800 Forbes St., Pittsburgh 13, Pa.
The Story of a Spark — 34 min. — silent or sound — 16 or 35mm.
Story of Arc Welding — 24 min. — silent or sound — 35mm.
Westinghouse Electric Corp., 306 Fourth Ave., P. O. Box 1017, Pittsburgh 30, Pa.
Westinghouse Motion Pictures and Slide Films for School Use
Willard Storage Battery Co., 246–286 E. 131st St., Cleveland 1, Ohio
The Story of the Storage Battery — sound — 16mm.
Wisconsin, University of, Bureau of Visual Education, University Extension Division, Madison 6, Wis.
Story of FM — 20 min. — sound — color (rental) — $1.50

Handcraft

Ohio Leather Co., 1052 North State St., Girard, Ohio
The Story of Leather — 16mm. (loan for two-week period)
Tanners' Council of America, 100 Gold St., New York, N. Y.
The Story of Leather — 16mm — sound or silent — 15 and 25 min. (transportation charges)
Wisconsin, University of, Bureau of Visual Education, University Extension Division, Madison 6, Wis.
Bulletin of Education Motion Pictures — 50 cents outside Wisconsin
Arts and Crafts of Mexico — 11 min. — sound (rental) — $1.25

Industrial and General

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
The Steam Turbine — 18 min. — sound
The Surface Condenser — 14 min. — sound
The Gas Turbine — 28 min. — sound
The Induction Heater — 12 min. — sound — color
Magic of Steam — Part 1 — 18 min. — sound
Magic of Steam, Part 2 — 14 min. — sound
Tornado in a Box — 28 min.
American Can Co., 230 Park Ave., New York 17, N. Y.
Alaska's Silver Millions — 30 min. — sound or silent — 16mm.
Jerry Pulls the Strings — 30 min. — sound — 16mm.
American Viscose Corp., 350 Fifth Ave., New York 1, N. Y.
How Rayon is Made — 15 min. — 16mm. — 1½ reels
Science Spins A Yarn — 25 min. — 2½ reels
Bausch & Lomb Optical Co., Rochester 2, N. Y.
Eyes of Science — 16mm. — silent
To Greater Vision — 16mm. — sound
Slides and Lectures:
Let's Make a Pair of Glasses — 32 slides 3¼ by 4 in.
Look Inside Your Eyes — 39 slides
J. I. Case Co., Racine, Wis.
(Use nearest branch office address when ordering films)*
Soil and Life — 10 min. — 16mm. — color — sound
Broad Base Terracing — 10 min. — 16mm. — color — sound
Build Good Terraces — 10 min. — 16mm. — color — sound
Level Farming on Sloping Fields — 10 min. — 16mm. — color — sound
Making Hay the Case Way — 10 min. — 16mm. — color — sound
Building A Pond — 10 min. — 16mm. — color — sound
Food and Freedom — 10 min. — 16mm. — color — sound
That the Millions May Eat — 10 min. — 16mm. — color — sound
Slide Films with Speaker's Manuals:
Starting New Tractors Right — 35mm.
Starting New Combines Right — 35mm.
Where Furrows Begin — 35mm.
More From Your Mower — 35mm.
Castle Distributors Corp., 30 Rockefeller Plaza, New York 20, N. Y.
(also at 135 S. LaSalle St., Chicago 3, Ill., and Russ Bldg., San Francisco 4, Calif.)
An Adventure in Learning — 20 min. — 16mm. — sound
The Search for Security — 17 min. — 16mm. sound

*J. I. Case Co. branch offices: 200 Seventh St., Rock Island, Ill.; 840 Washington St., Peoria 2, Ill.; 4260 Forest Park Blvd., St. Louis 8, Mo.; 202 S. Missouri St., Indianapolis 9, Ind.; 4 W. Eighth St., Des Moines 9, Iowa; 2133 Broadway, Kansas City 8, Mo.; 233 — 7th Avenue S., Minneapolis 15, Minn.; 9th & Dodge St., Omaha 2, Neb.; 121 N. Pacific Ave., Fargo, N. Dak.; 1649 Olentangy Rd., Columbus 8, Ohio; 1709 S.E. 3rd Ave., Portland 14, Ore.; 700 N. Main Ave., Sioux Falls, S. Dak.; 310 N. Austin St., Dallas 2, Tex.; 21 East Main St., Oklahoma City, Okla.; 360 W. Jefferson St., Syracuse 1, N. Y.; 523 Stewart Ave., Atlanta, Ga.; 107 N. Polk St., Amarillo, Tex.; 1933 Peralta St., Oakland 7, Calif.; 2203 Montana Ave., Billings, Mont.; 470 West 6th South St., Salt Lake City, Utah; 125 Higgins Ave., Winnipeg, Man., Can.; Broad St. & 8th Ave., Regina, Sask., Can.; 285 Wallace Ave., Toronto, Ont., Can.; 10th Ave. & 4th St. W., Calgary, Alta., Can.

Other Sources — Extension Services of the following: Kansas State College, Manhattan; So. Dakota State College, Brookings; No. Dakota State College, College Station; Oklahoma A. & M. College, Stillwater; University of Maryland, College Park; Purdue University, Lafayette, Ind.; University of Nevada, Reno; University of Tennessee, Knoxville; University of Minnesota, St. Paul; Montana State College, Bozeman; University of Florida, Gainesville; University of Colorado, Boulder; Iowa State College, Ames.

State Department of Education, Visual Education Service, Atlanta, Ga.

State Department of Education, Visual Education Division, Austin, Tex.

U.S.D.A. Soil Conservation Service Regional Offices: Center Building, 6800–16 Market St., Upper Darby, Pa.; Montgomery Bldg., 199 North Church St., Spartanburg, S. C.; 4650 Port Washington Rd., Milwaukee 12, Wis.; P.O. Box 1898, Fort Worth 1, Tex.; P.O. Box 713, Lincoln 1, Neb.; Box 1348, Post Office Bldg., Albuquerque, N. Mex.; P.O. Box 671, Portland 7, Ore.

From Bristles to Brushes — 30 min. — 16mm. — sound
The Turning Point — 22 min. — 16mm. — sound
Ever Since Eden — 35 min. — 16mm. — sound
The Alaska Highway — 12 min. — 16mm. — sound
A Fast Worker — 41 min. — 16mm. — sound (Suitable for high schools in rural areas)
Movies for Every Occasion — catalog
Films for School and Industry — catalog
Chicago Tribune, Tribune Tower, Chicago, Ill.
Trees to Tribunes — 16mm. — sound
The All American Way — 16mm. — sound
Music for Americans — 18 min. — 16mm. — sound
Eberhard Faber Pencil Co., 37 Greenpoint Ave., Brooklyn 22, N. Y.
Two Cents Worth of Difference — 30 min. — sound
Educators Progress Service, Randolph, Wis.
The Free Film Today (article)
Hammermill Paper Co., Erie, Pa.
The Voice of Business — 45 min. — 16mm. — silent — 3 reels
The Gift of Ts'ai Lun — Paper — 33 min. — 16mm. — sound
International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.
Romance of the Reaper — 30 min. — 16mm.
The Story of Binder Twine — 12 min. — 16mm.
Yesterday and Today — 10 min. — 16mm.
The Right Material in the Right Place — 20½ min. — 16mm.
Lindberg Engineering Co., 2450 West Hubbard St., Chicago, Ill.
Heat Treating Hints, 1st Edition — 49 min. — sound — color
Heat Treating Hints, 2nd Edition — 42 min. — sound — color
National Association of Manufacturers, 14 West 49th St., New York 20, N. Y.
Frontiers of the Future — 10 min. — 16mm. — sound
Your Town — The Story of America — 10 min. — 16mm. — sound
Three to be Served — 27 min. — 16mm. — sound
American Anniversary — 15 min. — 16mm. — sound
Remington Arms Co. Inc., Bridgeport 2, Conn.
*Also available in silent version.
Bird Dogs — 10 min. — 16mm. — sound
Big Fish — 10 min. — 16mm. — sound
Bob White — 10 min. — 16mm. — sound
**Fisherman's Paradise* — 10 min. — 16mm. — sound
**A Man, A Gun and A Dog* — 10 min. — 16mm. — sound
**Fishing Thrills* — 10 min. — 16mm. — sound
Hunting Thrills — 10 min. — 16mm. — sound
Snow Thrills — 10 min. — 16mm. — sound
On the Wing — 10 min. — 16mm. — sound
**Thrills in Wildest Africa* — 10 min. — 16mm. — sound
Hitting Flying Targets — 20 min. — 16mm. — sound
One Man Listens — 20 min. — 16mm. — sound

The Making of a Shooter — 10 min. — 16mm. — sound

Opportunity, Unlimited — 20 min. — 16mm. — sound

Society for Visual Education, Inc., 100 East Ohio St., Chicago 1, Ill.

The Sciences Section S.V.E. Library of Kodachromes

The Arts Section S.V.E. Library of Kodachromes

The Social Studies Section S.V.E. Library of Kodachromes

S.V.E. Pictorial Projectors for Industrial Use — equipment

S.V.E. Projectors for 2 by 2-in. Slides and 35mm. Filmstrips — equipment

Picturol Catalog, S.V.E. for Visual Education, single-frame, 35mm. — noninflammable film

Visualized Units in Color Catalog, S.V.E. listing of kodachrome 2 by 2-in. slides organized according to curriculum units, with teacher's manual

United States Steel Corp. of Delaware, 436 Seventh Ave., Pittsburgh 30, Pa.

Soil and the South — 20 min. — 16mm. — sound — color (This film distributed only in the states of Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee)

Vermont Marble Co., Dallas Branch for Films, 1513 Wall St., Dallas, Tex.

Mountains of Marble — 22 min. — 16mm. — sound

Cavalcade of Marble — 16mm. — sound — color

Wisconsin, University of, Bureau of Visual Education, University Extension Division, Madison 6, Wis.

Alaska: Reservoir of Resources — 10 min. — 16mm. — sound

Alaska's Silver Millions — 35 min. — 16-mm. — sound

Big Ditch of Panama — 8 min. — 16mm. — sound

Caribbean Sentinel — 12 min. — 16mm. — sound

Industrial Revolution — 30 min. — 16mm. — sound

Iron and Steel — 12 min. — 16mm. — sound

Petroleum and Its Products — 10 min. — 16mm. — sound

Pig Iron and Steel — 12 min. — 16mm. — silent

Story of Steel — 13 min. — 16mm. — sound

TVA (Tennessee Valley Authority) — 10 min. — 16mm. — sound

Brick and Stone Mason — 11 min. — 16mm. — sound — $1.25 (rental)

Conquest of the Night — 10 min. — 16mm. — sound — 50 cents (rental)

Heating and Air-Conditioning — 11 min. — 16mm. — sound — $1.25 (rental)

New Builders — 10 min. — 16mm. — sound — $1.25 (rental)

New Ways to Do More with Farm Power — 20 min. — 16mm. — sound — color — $1.50 (rental)

Painting and Decorating — 11 min. — 16mm. — sound — $1.25 (rental)

Plumbing — 11 min. — 16mm. — sound — $1.25 (rental)

Principles of Refrigeration — 20 min. — 16mm. — sound — $1.50 (rental)

Sulphur — 20 min. — 16mm. — sound — $1 (rental)

Metal

Aluminum Company of America, Motion Pictures Dept., 801 Gulf Bldg., Pittsburgh 19, Pa.

Unfinished Rainbows — 37 min. — 16 and 35mm. — sound

This Is Aluminum — 35 min. — 16 and 35mm. — sound

Aluminum Fabricating Processes — 20 min. — 16 and 35mm. — sound

Dateline Tomorrow — 19 min. — 16 and 35mm. — sound

General Sheet Metal Practice — 20 min. — 16 and 35mm. — sound

Blanking and Piercing — 15 min. — 16 and 35mm. — sound

Drawing, Stretching, and Stamping — 22 min. — 16 and 35mm. — sound

Tube and Shape Bending — 13 min. — 16 and 35mm. — sound

Spinning — 16 min. — 16 and 35mm. — sound

How to Machine Aluminum — 32 min. — 16 and 35mm. — sound

How to Rivet Aluminum — 26 min. — 16 and 35mm. — sound

How to Braze Aluminum — 7 min. — 16 and 35mm. — sound

Torch Welding — 17 min. — 16 and 35mm. — sound

Arc Welding — 10 min. — 16 and 35mm. — sound

Resistance Welding — 12 min. — 16 and 35mm. — sound

Association of Manufacturers of Chilled Car Wheels, 445 N. Sacramento Blvd., Chicago 12, Ill.

The Story of the Chilled Car Wheel — 27 min. — 16mm. — sound

Bethlehem Steel Co. Inc., Publications Dept., Bethlehem, Pa.

Highlights in Steelmaking, Part I — 42 min. — 16mm. — sound

Highlights in Steelmaking, Part II — 45 min. — 16mm. — sound

Carboloy Co. Inc., Box 237, Roosevelt Park P.O., Detroit 32, Mich.

(No loans made direct from Carboloy Company. List of film distributors furnished on request.)

Carboloy Training Films (set of six)

No. 1. What is Carboloy Cemented Carbide? — 35mm. — slides

No. 2. Designing Carboloy Tools — 35-mm. — slides

No. 3. Brazing Carboloy — 35mm. — slides

No. 4. Chip Breakers — 35mm. — slides

No. 5. Grinding Carboloy — 35mm. — slides

No. 6. Putting Carboloy Tools to Work 35mm. — slides

Film reference booklets for distribution to audience for use *only* in conjunction with film showings

(Above complete set of six films available for purchase also)

The DoAll Co., Minneapolis Div., 1301 Washington Ave., So., Minneapolis 4, Minn.

Sawing an Internal Irregular Shape

Filing an Internal Irregular Shape

The Versatile Contour Saw

Fellows Gear Shaper Co., Springfield, Vt.

Highlights of the Art of Generating and Gear Manufacturing Equipment — 55 min. — 16mm. — sound — color — 2 reels

General Motors Corp., Public Relations Dept., Detroit 2, Mich.

Film catalog describing more than fifty film subjects available in 16mm. — sound

Kansas, University of, Bureau of Visual Instruction, University Extension Division, Lawrence, Kans.

Airscrews — 16mm. — sound — 1 reel — $2 (rental)

Alloy Steels — 16mm. — sound — 2 reels — 50 cents (rental)

Aluminum, Blanking and Piercing — 16mm. sound — 2 reels — 50 cents (rental)

Aluminum, Drawing, Stretching and Stamping — 16mm. — sound — 2 reels — 50 cents (rental)

Aluminum, Fabricating Processes — 16mm. — sound — 2 reels — 50 cents (rental)

Aluminum, General Sheet Metal Practice — 16mm. — sound — 2 reels — 50 cents (rental)

This Is Aluminum — 16mm. — sound — 2 reels — 50 cents (rental)

Aluminum, Spinning — 16mm. — sound — 2 reels — 50 cents (rental)

Aluminum, Tubes and Shaping — 16mm. — sound — 2 reels — 50 cents (rental)

Arizona — Its Mineral Resources and Scenic Wonders — 16mm. — sound — 4 reels — 50 cents (rental)

Bulkhead I — 16mm. — sound — 2 reels — $2 (rental)

Bulkhead II — 16mm. — sound — 2 reels — $2 (rental)

Bulkhead III — 16mm. — sound — 2 reels — $2 (rental)

Countersinking, Counterboring and Spot Facing — 16mm. — sound — 2 reels — $2 (rental)

Cutting an External Acme Thread — 16mm. — sound — 2 reels — $1.50 (rental)

Cutting an External National Fine Thread 16mm. — sound — 2 reels — $1.50 (rental)

Cutting a Keyway on a Finished Shaft — 16mm. — sound — 2 reels — $1.50 (rental)

Cutting Keyways — 16mm. — sound — 2 reels — $1.50 (rental)

Cutting a Taper with the Compound Rest and with the Taper Attachment — 16mm. — sound — 1 reel — $1 (rental)

Cutting Thread with Taps and Dies — 16-mm. — sound — 1 reel — 50 cents (rental)

Drilling and Tapping a Cast Steel Valve Body — 16mm. — sound — 2 reels — $2 (rental)

Drilling, Boring and Reaming Work Held in Chuck — 16mm. — sound — 1 reel — $1 (rental)

Drilling a Hole in a Pin — 16mm. — sound — 1 reel — $1 (rental)

(To be continued)

Aviation Training in the Small High School

SAMUEL NICHOLAS
High School
Elgin, Ill.

Part I

The airplane, although not entirely a new development, has made such rapid advancement during the past decade that it must now be considered an important factor in present-day living. Distances have been shortened. The number of people employed in the field of aviation runs high. Many individuals have taken up private flying for purposes of recreation and business. The manner in which nations have used the airplane as an instrument of destruction indicates that the airplane can be used for destructive as well as for useful purposes.

Because of the social, political, and economic effects which were brought about by the advent of the air age, and because the field of aviation is fast becoming an industry which will modify the lives of many people, it is felt that some effort should be made to determine the extent to which aviation may be included in the industrial-arts program of the general high school. It was for this purpose that a study of the occupational areas of air transportation and airplane manufacture was made.

The following approach was used in attempting to find an answer to the problem "What aviation training should be offered in the industrial-arts program of the small high school?"

First, as far as possible, the significant aspects of aviation in the everyday life of the American citizen were determined by considering the (*a*) growth of commercial aviation; (*b*) efforts that both government and private business are making toward establishing aviation as a common feature of our everyday life; and (*c*) impetus that World War II has given aviation.

Secondly, the aims of secondary and industrial-arts education which had been most commonly agreed upon by leading educators and educational groups were determined.

Third, the physical requirements (shop space, equipment, personnel, etc.), costs, and other limiting factors involved in establishing aviation training as a part of the industrial-arts program of the small general high school were considered.

The fourth step consisted of an attempt to determine what aviation had to offer toward the fulfillment of the aims of secondary and industrial-arts education and still fall within the limitations outlined in the third step.

Significant Aspects of Aviation

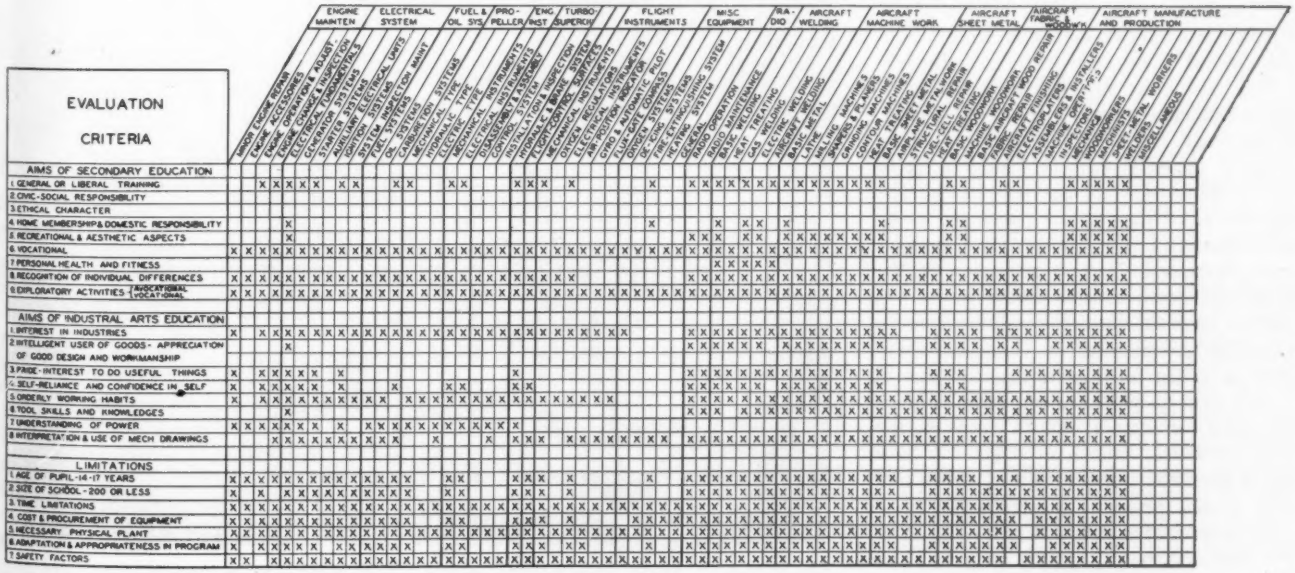
On May 15, 1918, the first air-mail route in the United States was opened between Washington, D. C., and New York City. The flight was made in the single-engine, open cockpit, wire-braced mail plane of 1918 which took off from a 17-acre, turf-surfaced field. What has the trend of aviation been since that time?

Analysis of available data[1] showed that the number of passengers carried rose from 5782 in 1926 to 3,035,755 in 1943. The revenue miles flown by domestic air carriers increased from 5,779,863 miles in 1927 to 105,433,061 miles in 1943. The revenue for all domestic carriers increased from $765,599 in 1926 to $122,995,574 in 1943. Pounds of express and freight carried increased from 1,733,090 pounds in 1926 to 64,329,774 pounds in 1943. It is apparent from this short survey that aviation grew steadily and continually from the very beginning. It is evidence of aviation's progress forward, and it can be assumed that from the momentum thus gained aviation will continue to move ahead.

Even though aviation has been continually growing and occupying a position of greater importance in our civilization, outside influences are affecting this growth and position of importance. They are: (*a*) federal legislation, (*b*) efforts of commercial

[1]Data obtained from: (*a*) *Annual Report of the Assistant Secretary of Commerce for Aeronautics to the Secretary of Commerce, Fiscal Year Ending June 30, 1931.* (*b*) *Second Annual Report of the Civil Aeronautics Authority, Fiscal Year Ending June 30, 1940.* (*c*) *Annual Airline Statistics (Domestic Carriers) Calendar Years 1938–1943,* Civil Aeronautics Board, Economic Bureau.

CHART I - OFFERINGS OF AVIATION FOR THE INDUSTRIAL ARTS PROGRAM


ENGINE MAINTEN
ELECTRICAL SYSTEM
FUEL & OIL SYS
PROPELLER
ENG INST
TURBO SUPERCH
FLIGHT INSTRUMENTS
MISC EQUIPMENT
RADIO
AIRCRAFT WELDING
AIRCRAFT MACHINE WORK
AIRCRAFT SHEET METAL
AIRCRAFT FABRIC WORK
AIRCRAFT MANUFACTURE AND PRODUCTION
EVALUATION CRITERIA
AIMS OF SECONDARY EDUCATION
1. GENERAL OR LIBERAL TRAINING
2. CIVIC-SOCIAL RESPONSIBILITY
3. ETHICAL CHARACTER
4. HOME MEMBERSHIP & DOMESTIC RESPONSIBILITY
5. RECREATIONAL & AESTHETIC ASPECTS
6. VOCATIONAL
7. PERSONAL HEALTH AND FITNESS
8. RECOGNITION OF INDIVIDUAL DIFFERENCES
9. EXPLORATORY ACTIVITIES (AVOCATIONAL / VOCATIONAL)
AIMS OF INDUSTRIAL ARTS EDUCATION
1. INTEREST IN INDUSTRIES
2. INTELLIGENT USER OF GOODS - APPRECIATION OF GOOD DESIGN AND WORKMANSHIP
3. PRIDE - INTEREST TO DO USEFUL THINGS
4. SELF-RELIANCE AND CONFIDENCE IN SELF
5. ORDERLY WORKING HABITS
6. TOOL SKILLS AND KNOWLEDGES
7. UNDERSTANDING OF POWER
8. INTERPRETATION & USE OF MECH DRAWINGS
LIMITATIONS
1. AGE OF PUPIL - 14-17 YEARS
2. SIZE OF SCHOOL - 200 OR LESS
3. TIME LIMITATIONS
4. COST & PROCUREMENT OF EQUIPMENT
5. NECESSARY PHYSICAL PLANT
6. ADAPTATION & APPROPRIATENESS IN PROGRAM
7. SAFETY FACTORS

What aviation training should be offered in the small high school

airlines to establish more lines (including freight service), and (*c*) technological advances made and being made to increase the safety factor and pay load of commercial type aircraft.

The efforts of the national government have already done much to aviation industry. The proper legislation and necessary appropriation to foster the construction of airways and airports, promote safety of air travel, and carry on aeronautical research will undoubtedly be still more helpful to aviation.

Considerable legislation concerning aviation was introduced in the 79th Congress. These legislative bills provide a clue to the attitude of the national government toward developing civil aviation. Proposed and passed legislation showed that Congress not only intended to appropriate monies for the physical development of civil aviation, but also intended to promote safe aviation travel, aeronautical research, and develop a backlog of trained personnel who are interested in seeing aviation grow.

What efforts are being made by the aviation industry to help its own cause? In a press release, the Air Press Service, a division of the Air Transport Association, presented figures on the proposed capacity of the airlines for the year 1947. By the end of 1945 the airlines reached a total high of 564 airplanes with a total seating capacity of 11,839 seats. However, before the end of 1947 the airlines expected to have a total of 1414 airplanes with a total seating capacity of more than 38,000 passengers. The airlines, then, as well as the national government are exerting an influence on aviation which should cause aviation to continue in its growth.

In addition to the direct influences of the airlines and the national government there are several important indirect influences which are acting upon aviation. The indirect influences to which reference is made include the technological advances being made to increase: (*a*) the safety factor in air travel and (*b*) the pay load of aircraft. Figures show that as the passenger death rate decreased, the number of passenger miles increased. Further reduction in the passenger death rate in airline travel will depend upon the nature of additional safety measures promulgated by Congress. However, it is not possible to legislate safety. Safety is largely dependent upon natural, technical, or human factors. Some of the more technical advances which are now being developed for commercial airline use, and should promote greater safety are: (*a*) pressurized cabins, (*b*) radar and other electronic devices, (*c*) radio altimeter, and (*d*) new type compasses.

As has already been pointed out, the factor of increasing the "pay load" of an airplane is important. The process of increasing the pay load of an airplane is largely technical in nature. There have been three major developments. They are: (*a*) the turbo-jet power plant, which provides speed approaching that of sound and at the same time reduces weight and vibration; (*b*) the laminar flow or high speed wing; and (*c*) a new "plate" wing structure.

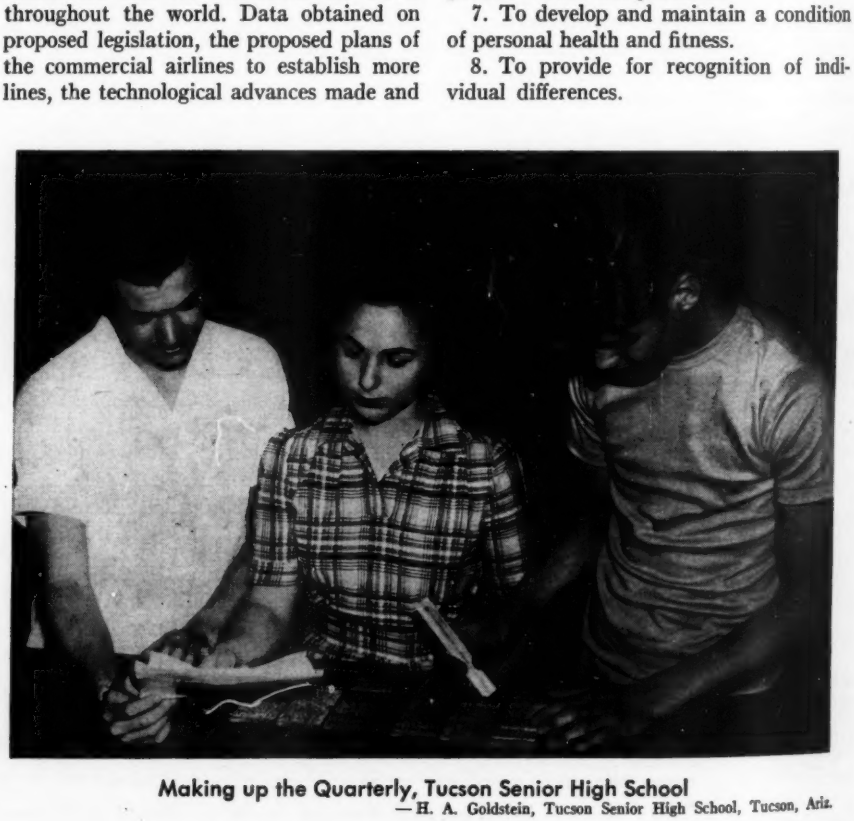
There have been, during the past five years, influences which have been acting upon aviation with such vigor that they cannot be overlooked. World War II has done much to place aviation on a more solid footing, both from the viewpoint of technical development and creating public interest. The Army Air Forces had a personnel strength of 2,330,000 men and women who were directly or indirectly concerned with aviation. The training given these people has provided a base upon which civil aviation can grow further. In addition to the extensive training program conducted by the AAF, the air transport system of round-the-world flights, as well as other regularly scheduled flights from the United States to Europe, India to China, Alaska to Russia, United States to the Southwest Pacific, etc., has probably blazed the trail for commercial air travel throughout the world. Data obtained on proposed legislation, the proposed plans of the commercial airlines to establish more lines, the technological advances made and being made to increase the safety factor and the pay load of aircraft, and the impetus that World War II gave aviation is evidence of forces which are acting on aviation in a most beneficial way.

Aims of Education

In order to determine the extent to which aviation may possibly serve as a desirable field in the high school industrial-arts program, the offerings of the field of aviation were evaluated in terms of fulfilling selected aims of education. The following list of the aims of secondary and industrial-arts education was based upon the (*a*) frequency with which the educational aim was expressed and (*b*) emphasis placed upon the aim.

Aims of Secondary Education

1. To provide a general or liberal education.
2. To prepare the individual for civic and social responsibility.
3. To provide for the development of ethical character of the individual.
4. To prepare for worthy home membership and domestic responsibility.
5. To provide for the worthy use of leisure time through development of the recreational and aesthetic aspects of life.
6. To prepare the individual as a prospective worker and producer.
7. To develop and maintain a condition of personal health and fitness.
8. To provide for recognition of individual differences.



Making up the Quarterly, Tucson Senior High School
—H. A. Goldstein, Tucson Senior High School, Tucson, Ariz.

9. To provide for exploratory activities —both for avocational and vocational ends.

Aims of Industrial-Arts Education

1. To develop an interest in the basic industries, life, and in methods of production and distribution.

2. To develop the ability to select, care for, and use properly the things the young citizen buys and uses and an appreciation of good workmanship and good design.

3. To develop an attitude of pride or interest in the individual's ability to do useful things.

4. To develop a feeling of self-reliance and confidence in the individual's ability to deal with people and to care for himself in unfamiliar situations.

5. To develop habits of orderly method of procedure in the performance of any task.

6. To develop elementary skills in the use of the more common tools and machines, and a knowledge of the methods of procedure in tasks frequently encountered by the average man together with a knowledge of the working qualities and characteristics of some of our most used materials.

7. To develop an understanding of the methods of production, transmission, and application of power, to the end that boys may become intelligent consumers of such power.

8. To develop in the individual an understanding of mechanical drawing, and skill in the interpretation of the conventions used in working diagrams, and in expressing his ideas by means of a drawing.

Limitations

To make certain that the information and data obtained are not haphazardly applied to all types of schools, certain limiting factors must be defined. Such factors as the size of high school, the age and background of the pupils who might possibly participate in an aviation program of a high school industrial-arts program, and the length of class periods for industrial-arts courses are the limitations.

Limitations of the problem to the small high school partially determined the age and background of the youth who may possibly participate in an aviation training program. To a great extent the background of such students is rural and small town in nature. Many have not had the close association with aviation such as urban high school students experience because of their proximity to airports and aircraft industrial centers.

It may be readily assumed that most industrial-arts courses found in the type of high school that are being discussed, generally operate on the double-period plan or two consecutive class periods of 45 to 50 minutes each.

Thus, three limiting criteria which must be considered in organizing an aviation program for the industrial-arts program of a small high school are: (*a*) the age of the pupil — 14 to 17 years, (*b*) the size of the high school — enrollment of 200 pupils or less, and (*c*) the time limitation or duration of the class period for shop courses.

The other limiting factors which must be considered for our list of criteria are: (*a*) cost and procurement of necessary equipment, (*b*) need for additional or specialized type of physical plant and equipment, (*c*) need for specialized and properly trained teacher personnel, (*d*) adaptation within present industrial-arts curriculum or appropriateness for providing worth-while shop experiences in industrial arts, and (*e*) consideration of safety factors made necessary by use of aviation equipment.

In considering the cost and procurement of equipment, it was found that considerable surplus aviation equipment has been made available to educational institutions through the Educational Disposal Section, Surplus Property Board, Reconstruction Finance Corporation. In addition to aviation equipment which has been made available, text material and training aids such as, training films and film strips have also been offered to the public schools at a nominal cost.

The afore-mentioned surplus aviation equipment, text material, and visual training aids which have been made available to the public schools indicate that little or no difficulty should be encountered in the procurement of such material at the present time. However, once the present surplus equipment has been distributed, the school will have to obtain other initial and replacement equipment directly from the manufacturer who will charge a sufficiently high price which will insure a fair profit. At the present time, cost of aviation equipment runs high. Therefore, it is felt that the factor of equipment costs and procurement must be included among the criteria of limitations.

Another limiting factor which must be given careful consideration is the physical plant (buildings and shop space) necessary for carrying on an industrial-arts aviation training program. There are various phases of aviation training which can be readily accommodated within present industrial-arts facilities without difficulty, such as aircraft sheet-metal work, welding, and radio repair. However, the phases of general aircraft maintenance and aircraft engine maintenance are not so readily accommodated in most of the present facilities of the small high school shop. They would present some of the following difficulties.

1. Need for sufficient shop space to house an entire airplane or major aircraft assemblies.

2. Need for large openings into shop space to admit major assemblies and subassemblies of aircraft.

3. Need for sufficient ceiling clearance to permit jacking-up of aircraft for normal overhaul and maintenance work.

4. Need for proper space providing controlled ventilation and heating, if dope and fabric work is to be carried on as part of aircraft maintenance.

5. Need for special equipment consisting of hoists, part racks, jacks (of sufficient capacity), and engine stands be required.

6. Need for shop space for engine overhaul and maintenance.

7. If engine run-up and test is to be included as a part of the program, special engine test cells with properly built engine frames will be necessary in order to safeguard against accidents and unnecessary noise in the shop. Such engine cells would include separate control rooms with insulated walls and double windows in order that proper instruction may be carried on with engines running.

It is believed that the need for special plant facilities and the difficulties which will be encountered by limitations of the physical school plant warrants the addition to the criteria list, the factor of physical plant limitations.

Safety in the aviation training program is of prime importance and should be one of the guiding factors in deciding what phases of aviation should be included in the industrial-arts program. In thinking of the safety factor in aviation training programs three elements should be considered: first, safety of personnel working with, around, and in aircraft; second, safety of material and equipment being worked on; and third, safety of both personnel and equipment, once the equipment is being actively utilized.

The availability of industrial-arts teachers sufficiently trained to carry on a program of aviation training in the industrial-arts shops of a small high school must also be considered. At the present time, one of the few sources of teacher personnel are the industrial-arts teachers who served with the army and navy air forces as technicians and instructors. It seems, however, that the availability of qualified teacher personnel is not a factor which need be included in our criteria, even if there may be a shortage

at present. A sufficient number of teachers can be trained by the universities and teacher-training institutions whenever the need arises.

The school curriculum is beginning to bear a great load and is being expanded in order to meet the needs of the American pupil more fully. Does inclusion of aviation training as a part of the industrial-arts program mean elimination of a portion of the present program, or is it possible to adapt an aviation training program to fit within the present structure of the industrial-arts program? Coupled with the problem of fitting aviation into the present curriculum is the question of the appropriateness of aviation training for providing worth-while shop experiences for a student of industrial arts.

As a final summary, the following limiting factors were utilized in this study as the basic criteria for determining the extent to which aviation training may be included as a part of the industrial-arts program: (1) age of pupil, (2) type of school, (3) time limitation, (4) cost and procurement of equipment, (5) physical plant limitations, (6) safety limitations, (7) appropriateness and adaptation in industrial-arts program. *(To be continued)*

Bridging The Gap

CLARENCE W. RIDGEWAY
Supervisor and Head of the
Industrial-Arts Department
High School
Millburn, N. J.

A student enters the six-year high school from an elementary school experience, his physical and mental being having been through certain fundamental processes, applicable to the younger child. He is now encountering an entirely different situation. From being the oldest in a group, he must now again become the *infant* in a new situation. This change of environment and routine demands much from the individual. This transition should be studied with the greatest of care, thoughtfulness, and consideration. The student should be made to feel welcome and secure. This transition is probably the most important event that has taken place in the pupil's life up to this time. His problems now are greater and he must, henceforth, have more personal consideration. He has become one of the many who enter the high school from the various elementary schools in a township or a city.

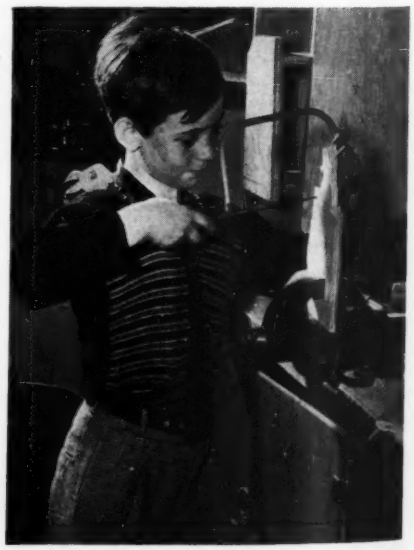
In this new environment there are many changes affecting the student. He has a home room with a different and more complex meaning than the one he belonged to in the elementary school. Now he has a different teacher for each subject. He may have an individual locker. He probably has to learn the procedure in the cafeteria. Many elementary schools assign no homework. Here in the new situation he may have homework assignments in all subjects. This whole adjustment is very difficult for an adolescent child.

Since there is a brief span of time left in which we as teachers may help this individual to put the finishing touches on the formation of some important habits, we must act instantly, effectively, yet thoughtfully, and carefully. The child must never become discouraged nor unhappy. Humiliation and embarrassment have such an adverse effect on a child's personality that teachers should be very careful to avoid sarcasm in any form. Teachers' expressions and impressions weigh heavily on a newcomer. Therefore, statements and comments should be the product of careful thinking. Praise and encouragement mean so much even to us "oldsters." A little pat on the back in praise offers the young student a certain sense of security that cannot be minimized.

Characters, personalities, and knowledge are the products of a schooling experience. The *finished product* must be considered when shaping, molding, and forming the student as he passes through his secondary school training. There should be a plan then, for the beginner. Certain rudimentary fundamental processes may be standard; however, individual differences must be recognized early and something done about them immediately. Individual conferences, if properly conducted and followed up, help the student to feel he is a real and important individual.

The writer's philosophy is that every student has just as much right to his opinions as the instructor, that the student should be guided instead of led, and when the teacher, through his years of training and experiences, realizes the student is not thinking in the correct and accepted way of society, then is the challenge to guide the student into channels of thinking and acting along accepted lines of thoughts. Such a philosophy encourages the student and makes him feel he really is somebody, and encourages him to do better work, to broaden his knowledge and be a good member of society. He is stimulated by feeling he is a part of society *now* and strive to be as good as, or better than, his fellow student.

We, as teachers and counselors, have a real task to perform; a challenge to meet, and an inspiration to fulfill. Too many times we lose sight of the ultimate and thereby lose prestige which is invaluable when a student enters our fold. We should never act on impulses. Statements and actions are difficult to rescind. An improper act, deed, or word may have an everlasting bad effect or influence that can never be completely healed. Let us not try to *kid* ourselves *nor the students*. The students are far more *wise* about the teacher than most of us realize. We are patterns for children. Let us endeavor to be the type of patterns we would like to see and associate with and be governed by in the future.



Elementary grade school student in the shop, Los Alamos, N. M. Jerome Leavitt, principal

Problems and Projects

ALUMINUM SERVING TRAY

HOMER C. ROSE
Falls Church, Va.

The small serving tray shown in Figure 1 is adequate for carrying four glasses. It makes an attractive piece to use with colored glasses and with most any table setting.

BILL OF MATERIALS

No. of pieces	*Name*	*Material*	*Size*
1	Body	Aluminum	3/32 x 4¼ x 13½
2	Handles	Aluminum	¼ x ⅞ x 3¾
2	Rods	Brass	¼ dia. x 12
4	Machine screws	Brass	8/32 x ¾

Suggested Procedure

1. Cut the material to size as shown in Figures 2 and 3.

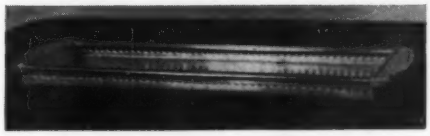


Fig. 1. Refreshment tray

2. Lay out the pattern for the body on suitable drawing paper, and cut to the line.

3. Mount the paper on the aluminum with an adhesive.

4. Center punch for the four holes.

5. Drill the holes with hand drill or use a drill press.

6. Remove the metal at the corners with fine tooth hack saw, using a wood block behind the metal to aid in sawing.

7. File the edges to shape with appropriate small half-round file. If a bench punch is available the edge can be cut to shape with a quarter-inch punch and die.

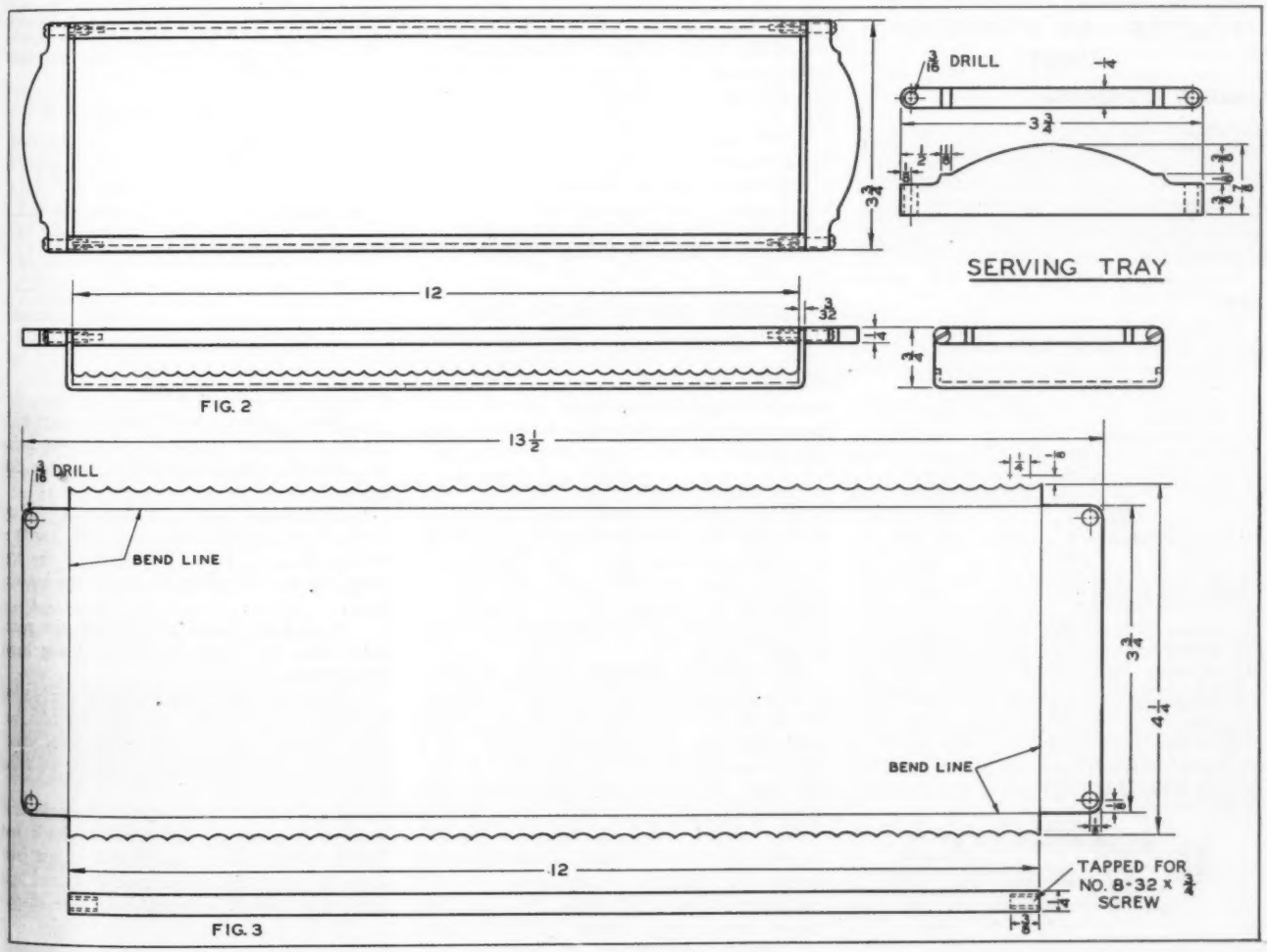
8. Bend the sides and ends up by clamping the metal between two iron bars and forming the edge over with soft mallet. The sides should be bent first, so that the ends when bent up extend over the ends of the sides.

9. Carefully round the exposed corners with a smooth file.

10. Cut the brass rods to length.

11. Drill for tapping. This may be done in the drill press if the stock is held in a vertical position by means of a drill press vise, or by chucking the piece in the lathe.

12. Tap the holes for No. 8–32 thread machine screws.



Details of aluminum serving tray

13. Lay out a pattern for the handles.
14. Mount this on the ¼-in. stock with an adhesive and cut the handles to shape with appropriate hack saw and files.
15. Center punch for and drill the holes.
16. Polish all parts.
17. Assemble the project.

Alternatives

The appearance of the screws may be improved by sawing a second screw driver slot at right angles to the original slot.

The design of the project would be very acceptable if the edges were left straight.

The brass rods could be eliminated entirely and the handles could be riveted to the end of the body.

A suitable etched design could be used on the body of the tray.

By increasing the width to 6 in., the tray could be used for serving eight people.

Wood handles of walnut, cherry, or mahogany, would be attractive with the aluminum tray. If wood is used, the thickness should be increased to ⅜ in.

ELECTRICAL INSTALLATION AND PRACTICE — AN INSTRUCTION SHEET

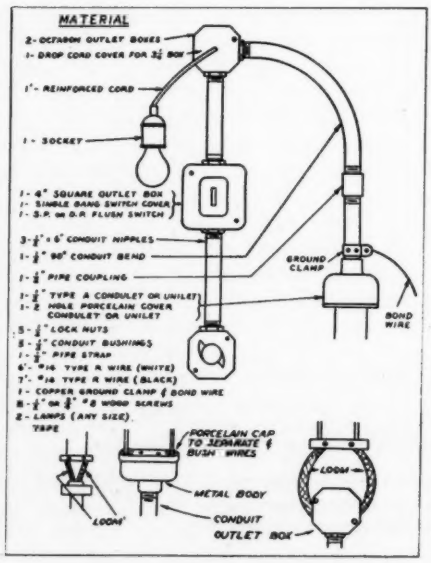
ELMER C. O'DONNELL
Vocational High School
New York City, N. Y.

Object: To provide practice in rigid conduit work and to adapt a commercial circuit to this type of construction. To teach the use of ground clamps and bonds.

Tools: Knife, cutting pliers, 4-in. screw driver.

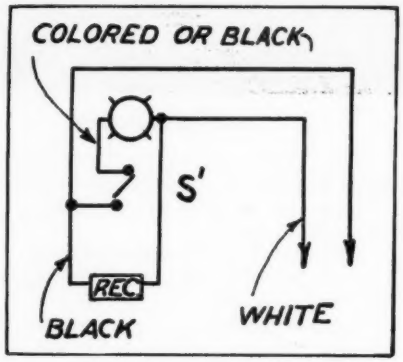
Trade terms: Unilet, condulet, ground clamp, metallic tubing, rigid conduit.

Information: Conduit runs may be grounded to other conduit or grounded equipment by means of short jumpers or bonds, properly attached to conduit.


MATERIAL
2- OCTAGON OUTLET BOXES
1- DROP CORD COVER FOR 3½ BOX
1'- REINFORCED CORD
1- SOCKET
1- 4" SQUARE OUTLET BOX
1- SINGLE GANG SWITCH COVER
1- S.P. or D.P. FLUSH SWITCH
3- ½" x 6" CONDUIT NIPPLES
1- ½" 90° CONDUIT BEND
1- ½" PIPE COUPLING
1- ½" TYPE A CONDULET OR UNILET
1- 2 HOLE PORCELAIN COVER CONDULET OR UNILET
5- ½" LOCK NUTS
5- ½" CONDUIT BUSHINGS
1- ½" PIPE STRAP
6'- #18 TYPE R WIRE (WHITE)
7'- #18 TYPE R WIRE (BLACK)
1- COPPER GROUND CLAMP & BOND WIRE
8- ½" or ¾" #8 WOOD SCREWS
2- LAMPS (ANY SIZE) TYPE
GROUND CLAMP
BOND WIRE
PORCELAIN CAP TO SEPARATE & BUSH WIRES
METAL BODY
CONDUIT OUTLET BOX
LOOM
LOOM

Three methods of rigid conduit to open wiring

Job: Dismantle this job and reconstruct it on work board. The switch is to be so connected that it will control only the pendent light, the receptacle to remain *hot*. Polarize the wiring. Lock nuts, bushings, couplings, and ground clamp must be made up tightly.



Wiring diagram of job

Questions:

1. What is the allowed carrying capacity (amperes) of No. 12 type "R" wire used: (*a*) wires in a conduit, (*b*) 5 wires in a conduit, (*c*) 7 wires in a conduit?
2. How many No. 14 type "R" single braid wires allowed in a ½-in. conduit?
3. Where conduit is installed underground, what types of wire must be used?
4. What is the largest size rigid conduit?

Reference: National Electric Code.

SCREW DRIVER WITH CAST ALUMINUM HANDLE

GEORGE J. ALLEN
Industrial Arts Department
Sewanhaka High School
Floral Park, N. Y.

The project described in this article embodies a variety of fundamental machine and hand operations. The construction of a tool of this nature possesses great boy interest, and uses but little material. From the teaching viewpoint this project covers a variety of operations from casting aluminum to using a single cut file.

The handle is made by casting aluminum in a permanent type metal mold. This mold can be made of low carbon steel in a school shop that has a metalworking lathe or a drill press. The aluminum required for casting may be melted in a commercial type atmospheric melting furnace, or a furnace with a fan or blower. In fact it is possible to melt the small amount of aluminum required by charging a cast iron pot with aluminum scraps and place it in a three burner bench type furnace commonly used for heating soldering irons. However, this method is not as satisfactory as the other methods mentioned.

The Aluminum Company of America, Pittsburgh, Pa., will furnish free plans for a shop built melting furnace that would be ideal for melting aluminum and costs only a few dollars.

The step by step procedure and working drawings as outlined may be used as a guide for the student in the construction of this project but it is possible to deviate in order to make the best possible use of your own shop facilities. The hexagon shape of the handle suggest the need for a shaper or milling machine with a simple indexing arrangement to form this shape from the round. Your particular shop may not have this equipment and the shape may be turned on a metalworking lathe with a diamond-pattern or straight-line knurl as shown in the shape variations. Many students may wish to draw original designs for this project as the variations that are possible are limited to only by the casting and blade sizes.

Making the Permanent Metal Mold

MATERIALS AND TOOLS REQUIRED

2 pcs. ¾ x 1¾ x 4⅛-in. cold finished low carbon steel
1 pc. 3/16 diam. x 3-in. polished drill rod
Layout fluid, rule, square, scriber, 3/16-diameter hand reamer, 3/16-diam. long length twist drill, No. 13 jobbers length twist drill, ⅞-diam. twist drill, center drill, single cut file

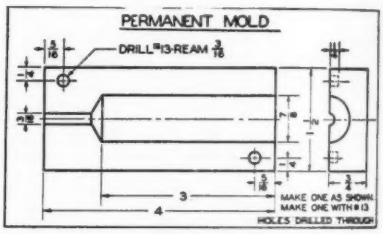


Fig. 1. Permanent mold

Procedure for making mold:

1. Select stock for mold, remove burrs with file, coat with layout fluid and lay out holes for drill rod pins as shown in drawing. See Figure 1.
2. Center punch at lay out lines, set up both pieces in drill vise and drill together with a No. 13 drill. Drill through the top piece and to a depth of ¼ in. in the bottom piece.
3. With both pieces still in the vise ream both holes for depths indicated, using hand reamer and cutting oil.
4. Remove burrs from a piece of 3/16 drill rod, cut to length, and with aid of arbor press drive pins through both halves of mold. Both halves should be held together with the pins.
5. Lay out correct length of mold and transfer to four-jaw independent chuck and face to length. Locate center and adjust jaws on chuck and center drill with combined drill and counter sink. The mold may be shaped to length with the aid of a metalworking shaper, center punched, held upright in a drill press vise and drilled in a drill press if a four-jaw chuck is not available.

6. Using correct speed and cutting oil, drill a 3/16-in. diameter hole with a jobbers length drill as far as you can go. Remove drill and substitute long length twist drill of same diameter, and finish drilling the hole through the piece. It is possible to make an extension drill for this purpose by brazing a length of drill rod to a jobbers length drill. In this manner you may be sure of perfect hole alignment which is essential.

7. Set lathe for correct spindle speed and enlarge hole to 7/8-in. diameter by several increments if necessary, checking for correct depth with depth gauge or rule. Cutting oil should be applied with a brush to aid in producing a smooth hole, and to help reduce tool friction.

8. Remove from lathe chuck, transfer to bench, separate mold, chamfer pins with file, remove all burrs and fit pins so the pieces go together easily. The permanent mold is then ready for use.

Casting the Aluminum Handle

MATERIALS AND TOOLS REQUIRED

Casting aluminum No. 112 (aluminum-copper alloy) or suitable scrap aluminum.
1 pc. carbon steel drill rod 3/16-in. diameter by 4 in. long.
C clamps, rule, tongs, asbestos gloves, apron, protective goggles, cast iron ladle.

Procedure for casting the handle:

1. Place drill rod blade in furnace, heat to forging temperature and flare out to prevent twisting in the mold, allow to cool slowly in air. See Figure 2.

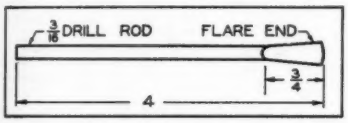


Fig. 2. Screw-driver bit

2. Insert blade in mold with flared end in, close mold, place C clamp near center and apply enough pressure to hold blade in correct position. Place entire assembly over flame or in a furnace and preheat to about 400 deg. F.

3. Melt aluminum and inspect frequently to prevent overheating. Correct pouring temperature may be accurately determined with a pyrometer holding a temperature range between 1200–1300° F. as ideal for this purpose. For best results the metal is gradually brought to the pouring temperature and poured with

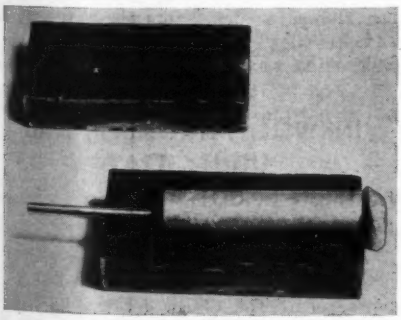


Fig. 3. The mold with the casting

Fig. 4. The casting as it comes out of the mold

a minimum of holding time. Experience will show the proper pouring temperature but it is well, in this case, to pour at the lowest temperature at which the mold can be filled to produce sharp, high tensile-strength castings without having misruns or cold shuts.

4. With the aid of tongs and heat resistant gloves place preheated mold in upright position and slowly pour in molten aluminum with as little agitation as possible. Observe safety precautions when handling molten metals by protecting hands with heat resistant gloves, wearing goggles, and apron or coveralls. *Keep moisture away — Play safe.* Allow sufficient time for cooling and remove casting from mold. See Figure 4.

Making the Handle

1. Place aluminum handle in three-jaw chuck extending about 1 in. from jaws and face smooth, with combined drill and countersink drill for center hole as shown in Figure 5.

2. Set up job in three-jaw chuck so that jaws close on the blade and the tailstock center will support the handle. Arrange lathe

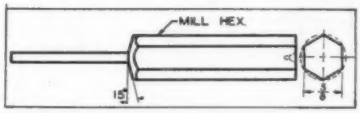


Fig. 5. Forming the handle into a hexagon

for turning, rough and finish turn aluminum section to given diameter. Then produce the hexagon shape on the handle by using the miller or the shaper. If these machines are not available in your shop the student may then proceed with one of the alternate shapes or one of his own design.

3. Transfer project to the milling machine, set up the index head to cut a 5/8-in. hexagon, as shown in Figure 5. Kerosene or soluble oil should be used as a coolant while the piece is being cut in order to produce a good finish on the work. Set up three-jaw chuck on lathe and place blade end in jaws and tighten in position. Support body with tailstock center and arrange proper spindle speeds for turning aluminum. Set compound rest to cut at 15-deg. angle as indicated.

4. Lay out length of taper, set compound rest to cut a 9-deg. taper with the center line and proceed to rough and finish turn the taper. A form tool ground to a 3/8-in.

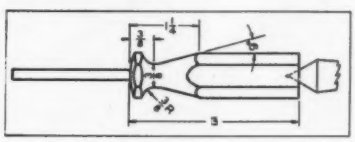


Fig. 6. Turning handle

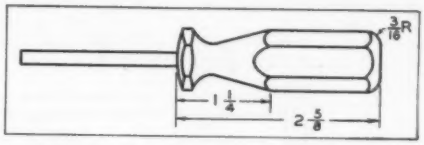


Fig. 7. Turning handle to length

radius with the proper clearance for aluminum will facilitate this operation. See Figure 6.

5. Set up job in three-jaw chuck with aluminum handle extending about 1 in. from jaws. Arrange lathe for facing; face off center hole and face handle to length as shown in Figure 7. Cut a 3/16 radius on end of handle and check with a radius gauge. With lathe set a high speed polish handle with a fine abrasive cloth and kerosene.

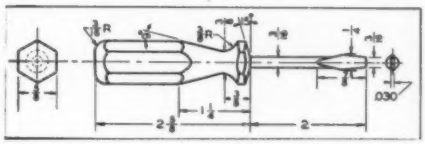


Fig. 8. Machining the blade

6. Transfer job to furnace, heat blade to forging temperature, forge blade to rough shape. Allow to cool slowly in air, rough and finish grind blade to dimensions shown in Figure 8. Draw file and polish blade with

Fig. 9. The finished screw driver

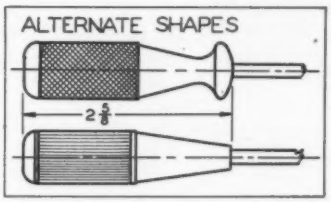


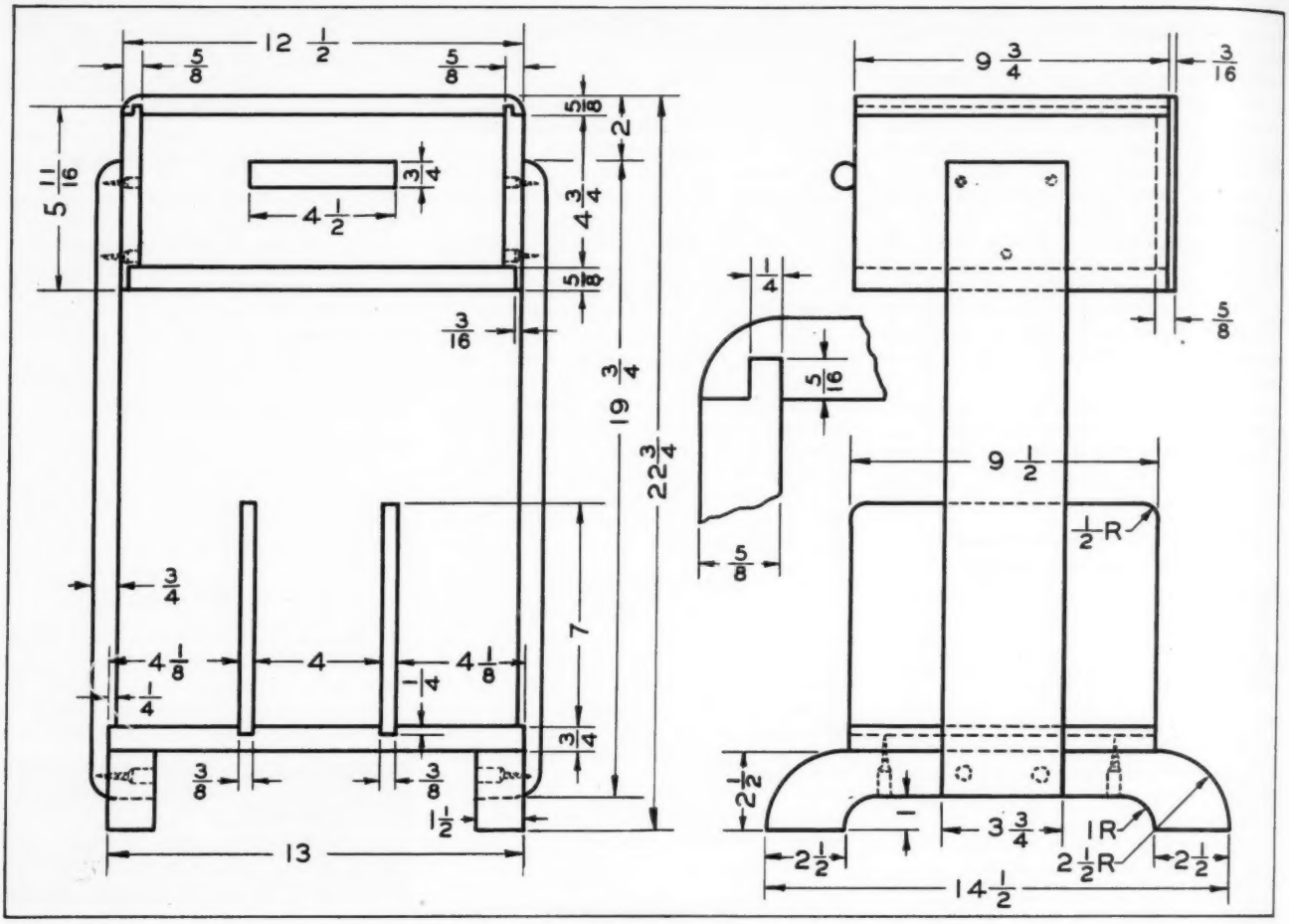
Fig. 10. Alternate handle shapes

abrasive cloth to remove grinding marks. Heat blade about 1 in. from end to critical temperature (test with magnet) and with rotary motion quench in cold water. Test for hardness with file, remove oxide with abrasive cloth and draw temper to a light blue color and again quench in water. Give job final polishing with fine abrasive cloth and kerosene. Project may be given a high luster by using a buffing wheel if this type of finish is desired.

SMOKING CABINET

ROBERT J. STARMER
Central High School
Flint, Mich.

The smoking cabinet was designed to be used as one of our projects for the beginning machine woodworking classes. It has proved



Smoking cabinet

to be a very successful project to teach the various beginning machine operations. It has been found that the stand has several uses other than as a smoking stand. It may be used as a bedside stand, end table, or sewing cabinet.

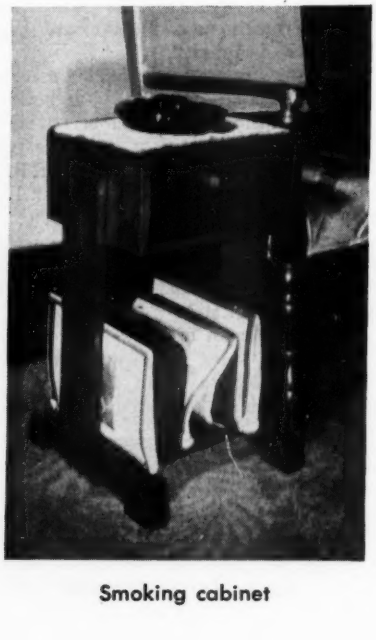
The drawer detail was left out to make the drawing clearer; standard drawer construction is to be used.

The top and sides of the box are easier to machine if left in one piece. Glue up the pieces for width, then square it up. Cut the end rabbets into which the bottom fits, then cut a dado for the joint at the top corners of the box. Set up the saw and cut the sides of the box to length. This will leave the top. Cut this to exact length and then cut the dado for the part of the dado-rabbet joint.

The uprights or legs are dadoed into the feet ¼ in., and the bottom which holds the magazine holder is dadoed ¼ in. into the uprights or legs. This adds a great deal of strength to the finished piece.

What the Student Should Be Able to Do:

1. Rip a board to width.
2. Crosscut a board to length.
3. Saw rabbet joints.
4. Crosscut pieces to length using the cut-off block.



Smoking cabinet

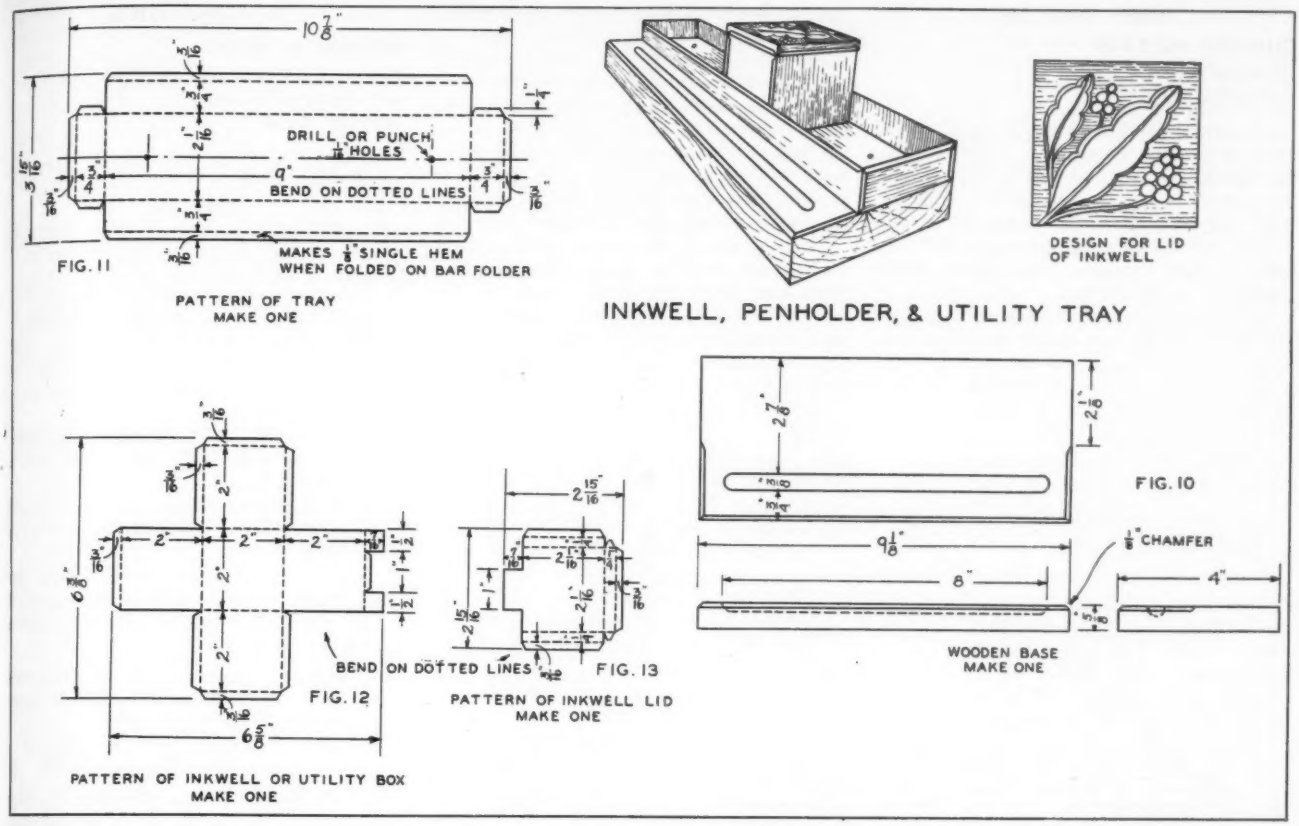
5. Crosscut pieces to length using the cut-off rod.
6. Cut dado joints.
7. Cut grooves.
8. Set rip fence.
9. Set the jointer tables for straight jointing.
10. Joint an edge.
11. Take out warp.
12. Take out wind.
13. Band-saw inside and outside curves.

We have used one coat of paste wood filler and five coats of linseed oil for a finish. Each coat of oil should be rubbed thoroughly and allowed to dry before the next coat is added. Follow the oil with a coat of wax and you have a very satisfactory finish.

INKWELL, PENHOLDER, AND UTILITY TRAY

FRANKLIN H. GOTTSHALL
Boyertown, Pa.

This is the second of a series of projects designed for a desk or writing table in a boy's room. The design for the lid is reproduced at full size to make it easy to use. Various colored enamels may be used to color


DRILL OR PUNCH 1/16" HOLES
BEND ON DOTTED LINES
MAKES 1/8" SINGLE HEM WHEN FOLDED ON BAR FOLDER
FIG. 11
PATTERN OF TRAY MAKE ONE
INKWELL, PENHOLDER, & UTILITY TRAY
DESIGN FOR LID OF INKWELL
FIG. 10
1/8" CHAMFER
WOODEN BASE MAKE ONE
BEND ON DOTTED LINES
FIG. 12
PATTERN OF INKWELL OR UTILITY BOX MAKE ONE
FIG. 13
PATTERN OF INKWELL LID MAKE ONE

Details of tray

the project. This project is nailed to a wooden base which may have a piece of felt glued to its bottom.

MATERIALS REQUIRED

1 base, wood, 5/8 by 4 by 9 1/8 in.
1 tray, tin, 3 15/16 by 10 7/8 in.
1 inkwell, tin, 6 3/8 by 6 5/8 in.
1 inkwell lid, tin, 2 15/16 by 2 15/16 in.
Solder
1 piece 14 ga. wire, 2 in. long.

Procedure

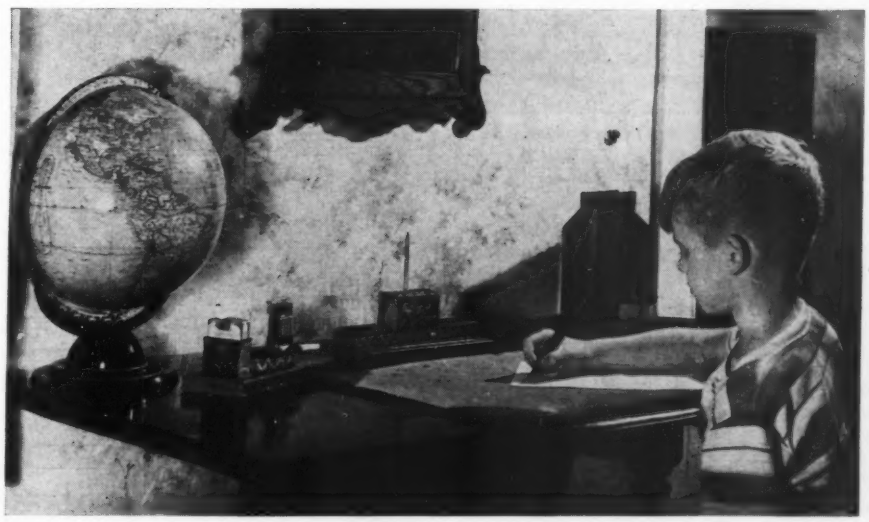
1. To make the base, secure a piece of wood, and plane and square it to the sizes given in Figure 10. Chamfer the edges as shown in the plan of Figure 10. Make layout for the groove, and chisel it out with a gouge. Sandpaper the base.

2. Make paper patterns of Figures 11, 12, and 13. Transfer these to the tin with a sharp scriber.

3. To make the tray, first turn the 1/8-in. single hems. Turn these on the bar folder, or start them with a hammer or mallet on the edge of an anvil, hatchet stake, or board. Hammer them down on a surface plate or anvil.

4. Bend the long sides of the tray first, as shown in Figure 6. Bend the short sides as shown in Figure 7. See Figures 6 and 7 on page 207 of the May, 1948, issue.

5. Bend the flaps and solder the joints.



Inkwell, penholder, and utility tray

6. Punch, or drill holes, and nail the tray to the base.

7. Turn the 1/8-in. hems on the inkwell, and on the inkwell lid.

8. Form the sides over a block of wood, cut to the size of the inkwell.

9. Turn the flaps and solder the joints.

10. Cut a piece of No. 14 wire, hold it against the back of the hinge flaps, and form them over the wire with flat-nosed pliers.

11. Remove the wire from the well, hold it against the flap on the lid and form that part of the hinge around the wire in the same manner.

12. Assemble the inkwell and lid as shown in Figure 9, page 207 of the May, 1948, issue.

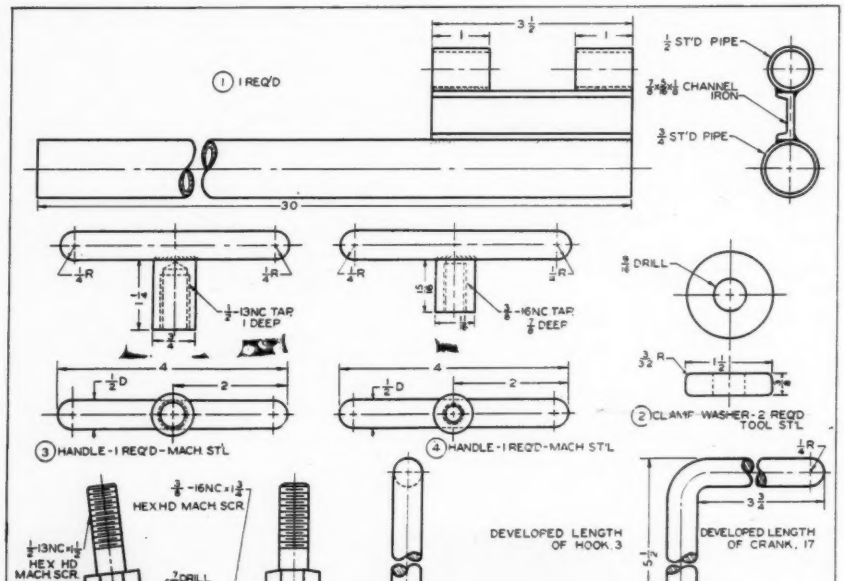
WIRE TWISTER

CLINTON HILLYARD
Howard Roosa School
Evansville, Ind.

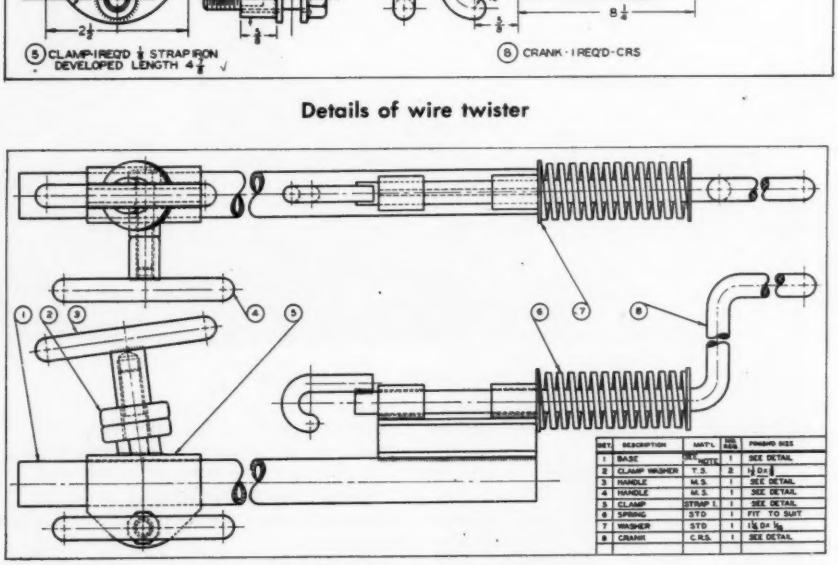
This wire twister is a handy piece of equipment to have in the shop. It is very simple to make if you have welding facilities available, and easy to operate. The twisting of wire is interesting to watch and do in this twister. All students like to watch the wire take on a uniformity in the spirals, while twisting is taking place.

Fasten the twister securely in a machinist's vise at the handle end. Determine about how long the finished product is to be, double that length, plus a little for shrinkage, taken up in the twist. Fold the wire, hook the folded end in the hook, and then move the chuck end so that the chuck will grip the ends of the wire. Tighten the tail assembly after taking the slack out at the hook. Now you are ready to twist the wire. If the twist is to be extremely tight, first twist a sample piece to test how much the wire will endure.

The question is frequently asked, "What projects can be made with such a gadget?" Well, here are a few of the many that can be made: potato masher, egg whipper, toasting fork, grill sets, and fly swatter handle.



Details of wire twister



Assembly of wire twister

AERONAUTICS

WILLIAM E. NAGEL
Assistant Professor of Engineering
University of Wichita
Wichita, Kans.

(Continued from page 28 of the January, 1948, issue)

UNIT VIII

Nautical Astronomy

I. Our planetary system

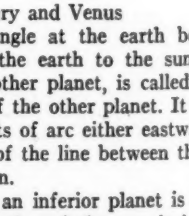
A. The origin of the planets, it is believed, is that they came from the same body—the main portion of which is our sun. They were thrown off by centrifugal force and by disturbances caused by the approach of another large mass.

1. All revolve about the sun in the same direction in orbits very close to the same plane.
2. Each planet rotates on an axis and all rotate in the same direction of revolution.

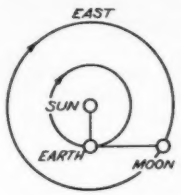
B. Sidereal period is the interval of time for a planet to complete one revolution about the sun with respect to a distant point in space.

1. Balance between force of gravitation and centrifugal force keeps the planet in its elliptical orbit.
2. The major axis of the orbit of a planet is called the *line of apsides.*
   a) The extremity of the line of apsides nearest the sun is called perihelion.
   b) The point on the line of apsides farthest away from the sun is called aphelion.

C. Planets whose orbits lie inside the orbit of the earth are called inferior planets.

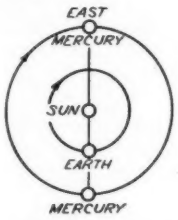


1. Mercury and Venus
2. The angle at the earth between lines from the earth to the sun, and earth to another planet, is called the elongation of the other planet. It is measured in units of arc either eastward or westward of the line between the earth and the sun.
3. When an inferior planet is in line with the earth and the sun it is in inferior conjunction when it is between the earth and the sun.
4. When the sun is between the earth and another planet it is said to be in superior conjunction.
5. The time for an inferior planet to go from one inferior conjunction to the next inferior conjunction is called its synodic period.



D. Planets whose orbits lie beyond the orbit of the earth are called superior planets and are Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto.

1. When the elongation of a superior planet is 90 deg., the planet is said to be in quadrature.
2. When a superior planet is in line with the earth and the sun it is said to be:
   a) In conjunction when it is on the same side of the earth as the sun is.
   b) In opposition when it is on the opposite side of the earth from the sun.



3. An inferior planet can never be in opposition and a superior planet can never be in inferior conjunction.

E. Physical characteristics of planets.

1. The earth is approximately spherical in shape with a pole diameter of 7900 miles and a diameter of 7927 miles. It rotates from west to east and makes one rotation each sidereal day. It revolves about the sun in an elliptical orbit from west to east at about 18½ miles per second. The average distance from the sun is about 92,981,000 miles. It has a mean density of 5.5; a mass of 6 by 10^{21} metric tons; and makes a 23½-deg. angle from perpendicular for its axis of rotation. A gaseous atmosphere bound to the earth by gravity, protects it from meteors which are burned to gas before they penetrate to the earth. Without this gaseous atmosphere there could be no rain or clouds. The troposphere extends about seven miles above the earth's surface. The practical limits of the stratosphere is about 100 miles; however, the Aurora Borealis has been observed at a 600-mile height.
2. The sun is the center of the solar system. It is only one of many countless systems. It is of enormous size in comparison with the earth but only average in size, density, temperature, chemical composition, and brightness in comparison with other stars. Its diameter is about 864,390 miles (110 times that of the earth). Its volume is 1,300,000 times that of the earth. The density of the sun is only ¼ that of earth. The surface temperature is estimated between 10,000,000 and 40,000,000 deg. C. It is not a gaseous mixture but either a liquid or a solid. The surface of the sun is called photosphere. All lengths of light rays are produced and it has a continuous spectrum. The inner core has elements of greater atomic weight than uranium which exist in a liquid state too hot for atomic combinations. The reversing layer of gases lies immediately above the photosphere with a comparatively low temperature. This layer is about 3000 miles thick. The chromosphere is the upper 6000 miles of solar atmosphere. During a total eclipse a halo called a corona extends out from the sun to distances of 700,000 miles or more. The nature of the corona is speculation as it has only been studied a total of one hour by modern methods. Sun spots have black centers called umbra and the surrounding light zone is called penumbra. They have a tendency toward roundness in shape. The smaller ones are 300 miles in diameter, and the larger ones 60,000 miles. The start of a sun spot is marked by some disturbance. The average life of a sun spot is from one to two weeks. They follow a cycle as to maximum and minimum number; about every 11 years they reach a maximum. Terrestrial aurora follow sun spot periodicity as do changes in the earth's magnetic field. Weather and temperature of the earth have not so far been connected definitely with them. The sun rotates from west to east and does not have a uniform rotation at the poles and equator. The atomic theory is the explanation of the maintenance of temperature despite radiation losses. As atom disintegrates enormous energy is released and if annihilated a larger amount of energy would result. It will be about $25{,}000{,}000^{100}$ years before the sun loses any heat noticeably.
3. The moon is a satellite of the earth. It is about 240,000 miles from the earth. It is 2160 miles in diameter, has a mass of .0123, and a density of 3.4 times that of water. It has one sixth of the earth's force of gravity. The lunar moon has a temperature of 250 deg. F., and a minimum just before sunrise of —150 deg. F. It has no appreciable atmosphere. Its surface is composed of seas, mountains, craters. The seas are from 150–500 miles across. There are ten ranges of mountains with some 20,000-foot heights. The craters are very large; some 150 miles across. However, they have no erupted matter or lava. They are believed to have been formed by meteors striking the moon.
4. The planets are celestial bodies that change positions relative to other bodies from day to day or from week to week. They are seen by reflection and not by their own brightness.
   a) The zodiac is a wide band parallel to and bisected by the ecliptic. It contains paths of the sun, moon, and all planets known to the ancients. It is divided into 12 parts called signs corresponding to the constellations in the zodiac.
   b) All planets revolve around the sun from west to east and the satellites revolve about their planets from west to east.
   c) Mercury is too near the sun to be easily observed. The maximum elongation is only 28 deg. It has a very limited atmosphere. It gets 7½ times as much sunlight as the earth. Probably no life as we know exists.
   d) Venus has an atmosphere heavily laden with clouds. Its elongation is about 46 deg. It is very bright and often used as a morning or evening star by navigators.
   e) Mars has white polar caps that vary in size with change of seasons, a positive evidence of vegetation, and has markings called canals which lead to speculation of the planet being inhabited by intelligent beings.
   f) Jupiter is largest of the planets and one of the brightest. It is oblate in shape due to its rapid rotation, receives only $\frac{1}{27}$ as much heat from the sun as the earth does. It has a heavy cloud-laden atmosphere and a fairly solid mass within. Probably has no life.
   g) Saturn has rings around it. It is used for navigational purposes.
   h) Uranus, Neptune, and Pluto. Very little known about the physical composition due to the great distance from the sun. It is extremely cold and probably no life exists.
5. Asteroids are small heavenly bodies. Only about 2500 have been discovered. The largest is only 500 miles in diameter. They lie between the orbits of Mars and Jupiter. First discovered in 1801.
6. Comets are small nucleus accompanied by considerable gaseous matter. They move in long elliptical orbits and have regular periods. As a comet approaches the sun the *tail* turns away from the sun. Halley's comet is perhaps the best known and has a period of 75.5 years. It was last seen in 1910.
7. Meteors are small particles of matter which radiate from certain definite portions of the sky. They become incandescent in the earth's atmosphere and are called *shooting stars*. The portions which reach the earth's surface before being burned are meteorites. They are made of iron principally and have weighed as much as 50 tons.

II. The earth's orbit

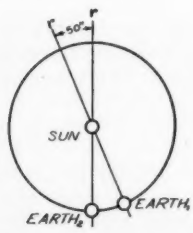
A. The plane of the equator extended into space is called the plane of the equinoctial, which makes a 23½-deg. angle with the plane of the earth's orbit.

1. The intersection of the plane of the equinoctial and the plane of the earth's orbit intersect in a line of intersection called the line of equinoxes.

B. As the earth revolves about the sun, the sun will sometimes be northward or southward of the plane of the equinoctial.
   1. In changing the declination from south to north the extremity of the time of equinoxes which is in the same direction from the earth as is the sun in the vernal equinox (March 21).
      a) When changing declination from north to south the sun is in autumnal equinox (September 23).

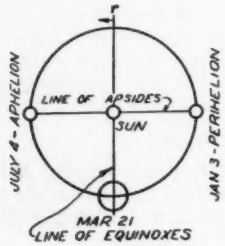
C. The declination of the sun changes most rapidly on March 21 and September 23. On June 21 and December 21 the change in declination is negligible and is called the summer solstice and winter solstice respectively. Solstice means "the sun stands still."

D. The line of equinoxes does not remain parallel to its original direction in space moving westward about 50 seconds a year. Makes one complete rotation every 28,500 years.
   1. The period of time for the earth to make one complete revolution is called a sidereal year.
   2. The interval between two successive passages through the vernal equinox is called a tropical year which is fifty seconds shorter.



E. The calendar year is based on the tropical year in order to keep the months in phase with the seasons. If sidereal years were used, due to the shifting, the summer would be in December, etc.

F. The earth is slowly rotating in its own plane so that the line of apsides rotates every 100,000 years. Perihelion will meet the vernal equinox once each 21,000 years. (Perihelion now on January 3.)
   1. The interval between two successive perihelions is called an anomalistic year which is five minutes longer than a sidereal year.



G. The sun is not in north declination one half of the time or in south declination half of the time; only when the lines of the equinoxes and apsides coincide are they equal. Now it is in north declination seven days longer. In about 10,500 years the perihelion will be July 4 and in south declination seven days longer.

H. The pole star (polaris) will not always be the pole star. In the course of 26,000 years due to the procession of the equinoxes every star in celestial latitude 66½ N will be the pole star. Vega will be in about 12,000 years.

III. The seasons

A. Reason for the seasons is due to two facts.
   1. The variation throughout the year in the amount of sunlight received in a given place.
      a) Due to the 23½-deg. declination of the earth's axis.
   2. The greatest angle at which the sun's rays strike the surface of the earth changes as the declination changes. Rays are more slanting in winter than in summer.

B. Days and nights of equal length at the equator.
   1. They have only two seasons due to this, commonly called the *rainy* and the *dry* season.
   2. Summers in the northern hemisphere are actually hotter than the same periods near the equator.

IV. The moon's orbit

A. The moon revolves about the earth in an elliptical orbit, at a mean distance of 240,000 miles.
   1. One half of the surface of the moon is illuminated by the sun. The angle at which we see the lighted areas causes the phases of the moon.
      a) The interval between two successive occurrences of the same phase is called synodic month which is equal to 27.32 days (solar).
      b) The moon rotates on an axis once in a sidereal month so we always see the same side of the moon.

V. The stars

A. The nature of the stars
   1. Spacing and apparent lack of motion in space afford the navigator a means of determining his position.

B. Many stars have names and practically all those visible to the eye have designations such as alpha, beta, etc.
   1. Northern Hemisphere
      a) Big dipper (Dubhe, Merak)
      b) Polaris
      c) Casseopeia (Caph) which during the present era indicates approximately the local sidereal time.
      d) Vega
      e) Denib
      f) Arcturus
      g) Spica
   2. Southern hemisphere
      a) Betelgeus
      b) Orion
      c) Sirius (the brightest star)
      d) Castor and Pollux (the twins, Gemini)
      e) Aldebaran
      f) Procyon
      g) Regulus

C. The complete revolution of these stars occurs each sidereal day and is approximately four minutes shorter than the solar or calendar day which causes different constellations to appear during the year.

D. There are probably about 300,000,000,000 stars of which about 7000 are visible to the naked eye. All may be viewed in one night on the equator. They vary in size, some being smaller than our sun, and others such as Antares which is 400,000,000 miles in diameter but is so far away as to be a mere pin point.

E. Galaxy is a system resembling a cloud of faint stars with interspersed dark areas. The dark areas are not voids but are masses of matter which obscure what lies beyond.

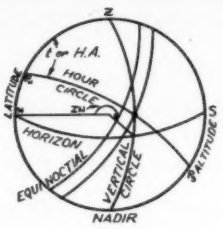
F. Galactic nebulae are clouds of dust and gaseous matter within our universe and are not self-luminous but reflect light from other stars.
   1. Extra galactic nebulae lie outside our universe and are complete universes in themselves and give out millions of times as much light as our sun.

G. Star clusters
   1. Open clusters consist of comparatively few stars — the nearest being Hyades 10,000 light years away.
   2. Globular clusters contain many thousands of faint stars packed together. Centaurus is 21,000 light years away.

H. Definitions used in referring to stellar distances and to brightness of stars.
   1. Parallax of a star is the angle subtended at the star by the radius of the earth's orbit.
   2. A parsec is the distance at which a star would have a parallax of one second.
   3. A light year is the distance traveled by light in one year (186,000 miles/second).
   4. The astronomical unit is the mean distance from the earth to the sun (92,918,000 miles).

VI. The celestial sphere is a sphere of infinite radius, with its center imagined to be at the center of the earth.

A. Two systems to designate location are used.
   1. Horizon system is used to locate points in relation to a given position of the earth. It is a ready means of locating a body on the celestial sphere in relation to the horizon of the observer. The co-ordinates are determined by direct observation.
   2. Equinoctial system is used to designate positions without respect to any particular point on the earth, since the



altitude and azimuth of a body at a given time would be different for observers in different places. Co-ordinates are found in the Nautical Almanac which which gives both time and arc units or in the Air Almanac which uses arc units only.

B. Co-ordination of the two systems (altitude of the elevated pole is equal to the latitude of the observer).
   1. Altitude, 30 deg.; azimuth, 215 deg.; latitude, 25 deg. N. Declination about 20 deg. S. Hour angle (H.A.) or t is 40 deg. W., or 2 hour–40 minute W. It is customary to place north on the left and south on the right regardless of whether the observer is in north or south latitude.

VII. Time

A. There are four kinds of time.
   1. Local sidereal time.
   2. Local civil time. The nautical almanac and air almanac are based on 0 meridian (Greenwich, England) using Greenwich Civil Time (GCT).
   3. Local apparent time, which is local time plus equation of applied time.
   4. Zone time (15 of longitude in width for one zone).

B. Timepieces used are chronometers which are set for Greenwich time instead of local time.

(To be continued)

AN EFFICIENT VISUAL AID DEVICE

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Buffalo, N. Y.

"One picture equals one thousand words." Terse and succinct is the old Chinese maxim that expresses the educational values of visual-sensory aids. The need for techniques to motivate and stimulate learning through the senses is indicated by the growing popularity and use of visual aids. The need for devices that can be used to teach students the meaning of words can never be overemphasized. The projector, camera, microscope, blackboard, map, and diagram are but a few of the many visual aids. Such aids are used in many new and novel ways.

A new type of visual aid is the photo-instruction box. It has been devised to supplement existing teaching aids and instruction sheets. Sequent operations are accompanied by photographs and the successive operations may be made to appear as pictures in an opening. This particular series represents the basic steps for the making of a casting. So it is intended that this aid be mounted close to the foundry bench where it will be readily accessible to the student.

The photoinstruction aid consists of a box-like structure with rounded ends. Two rollers within the box hold a film on which are mounted the photographs and instructions that appear in the two openings on the surface of the box.

A practical method of mounting the photographs to assume a cylindrical shape presented a problem. Chartex was found to be an adequate backing. It is a cloth, impregnated with a waxlike adhesive that requires heat for mounting. The source of heat was an electric flat iron. Narrow strips of masking tape were used to locate the photographs and instructions on the Chartex while administering the heat.

Information concerning Chartex may be obtained by writing to: Chartex Seal, Inc., Shelton, Conn.

Dimensions of the component parts are entirely arbitrary. The photograph size predetermines the width of the Chartex backing and spool dimensions. All parts were assem-

Fig. 1. The photo-instruction box

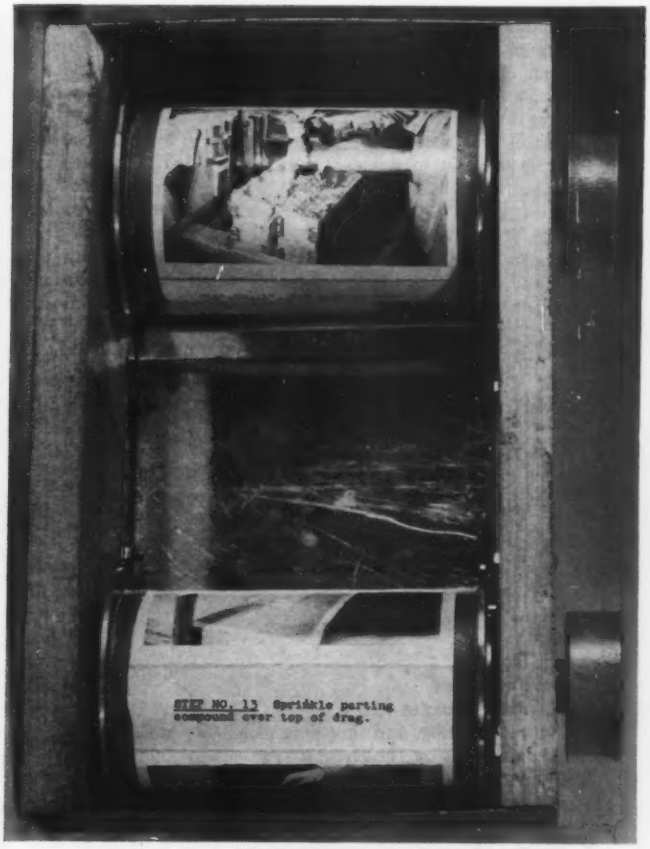


Fig. 2. Assembly details

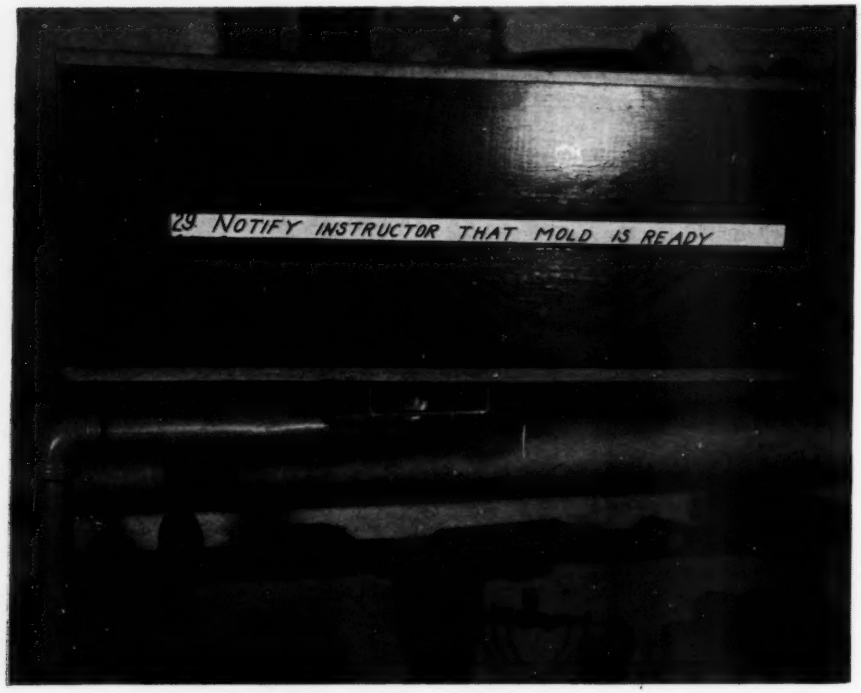


Fig. 3. Visual instruction box

bled as compactly as possible. Exposures were made with an Argus C-3 camera on 35mm. film with the use of two R-2 photoflood lamps. The prints were enlarged to 3¼ by 4½ in.

The spool is turned with an integral shaft. Aluminum disks attached to the ends of the spool act as guides for the film. A smaller aluminum disk placed on the knob end of the shaft spaces the spool from the side piece. End thrust is eliminated by an adjusting screw on the shorter end of the shaft.

A thin sheet of Lucite is cemented on the underside of the opening to protect the instructional material. To position this material close to the opening an adjustable metal plate is provided.

Figure 2 shows the assembly. It is evident that dimensions can be varied to accommodate the desired print size. Over-all size is left to the discretion of the builder. This particular aid which is designed for wall mounting, has the following dimensions: 4 by 6 15/16 by 11⅛ in.

The subjects available for the photoinstruction aid are unlimited. The following list suggests only a few of the many possibilities:

Bookbinding
Hand building
Slipcasting
Throwing
Finishing
Timing engines
Silk-screen process
Cutting, reaming, and threading pipe
Cutting joints on the circular saw

The writers feel that the photoinstruction aid can become a means of greater motivation and stimulation in the shop. Such a device will improve the recall of demonstrations and reduce pupil dependency upon the instructor. The quality and quantity of work performed by the students will both improve and increase. With this, greater accuracy in the learning of manipulative skills can be expected.

This device represents a revision of an existing teaching aid which indicates, through an opening, the sequent operations that are listed on a revolving drum. See Figure 3. This is used in the general shop at the New York State College for Teachers at Buffalo, and was contrived by Fred C. Finsterbach, instructor.

For those who wish to duplicate this particular sequence the following list is prepared. Those items starred (*) are accompanied by photographs in the photoinstruction aid.

1. Place drag on the molding board.*
2. Center pattern in drag, widest side down.*
3. Sprinkle parting compound on pattern.*
4. Sift sand over pattern about 1 in. deep.*
5. Press sifted sand about pattern with fingers.*
6. Half-fill drag with sand, peen ram at sides.*
7. Overfill drag with sand, butt ram flat.*
8. Rub off extra sand with strike bar.*
9. Scatter fine sand over drag and place follow board.*
10. Hold board, turn mold over. Take off top board.*
11. Cut sand with slick to parting lines.*
12. Remove all loose sand from parting surfaces.*
13. Sprinkle parting compound over top of drag.*
14. Fit the cope half on the drag.*
15. Set sprue pin near pattern at best position.*
16. Cover surface with sifted sand, then fill cope.*
17. Ram sand in cope and around sprue pin.*
18. Smooth sand on top of cope with trowel.*
19. Remove sprue pin. Pack all lose sand with fingers.*
20. Lift cope very carefully and set it aside.*
21. Ventilate cope at far points of pattern.*
22. Moisten the sand at edge of pattern.*
23. Set lifting pins in position on pattern and tap lightly, then lift pattern.*
24. Repair broken edges with slicks.*
25. Cut gates from mold toward sprue pin.*
26. Replace cope on drag in correct position.*
27. Place weights on corners of cope.*
28. When pouring metal wear goggles and asbestos gloves.*
29. Notify instructor that mold is ready.
30. While metal cools, tidy up around foundry bench.
31. Take mold apart and clean casting with brush.
32. Cut off gates and risers from casting.
33. Restore foundry in good order. Report to instructor.

Sincere appreciation is extended to Mr. Finsterbach for presenting the opportunity to develop this teaching aid and for his encouragement and advice.

BILL OF MATERIAL

No. Reqd.	*Name*	*Material*	*Size*	
1	Cover	Tin plate	7″	17⅝″
1	Film plate	Tin plate	5 5/16″	6⅞″
2	Side	Wood ¾″	4″	11⅛″
2	Spool	Wood 2½″ dia.	2½″ dia.	5″
2	Shaft	Wood ¾″ dia.	¾″ dia.	7 11/16″
2	Knob	Wood ¾″	2⅛″ dia.	
2	Spacer	Aluminum ⅛″	2″ dia.	
4	Spool disk	Aluminum ⅛″	3½″ dia.	
1	Window	Lucite .010″	4½″	6¾″

INDIAN SILVERSMITHING

BEN HUNT
Hales Corners, Wis.

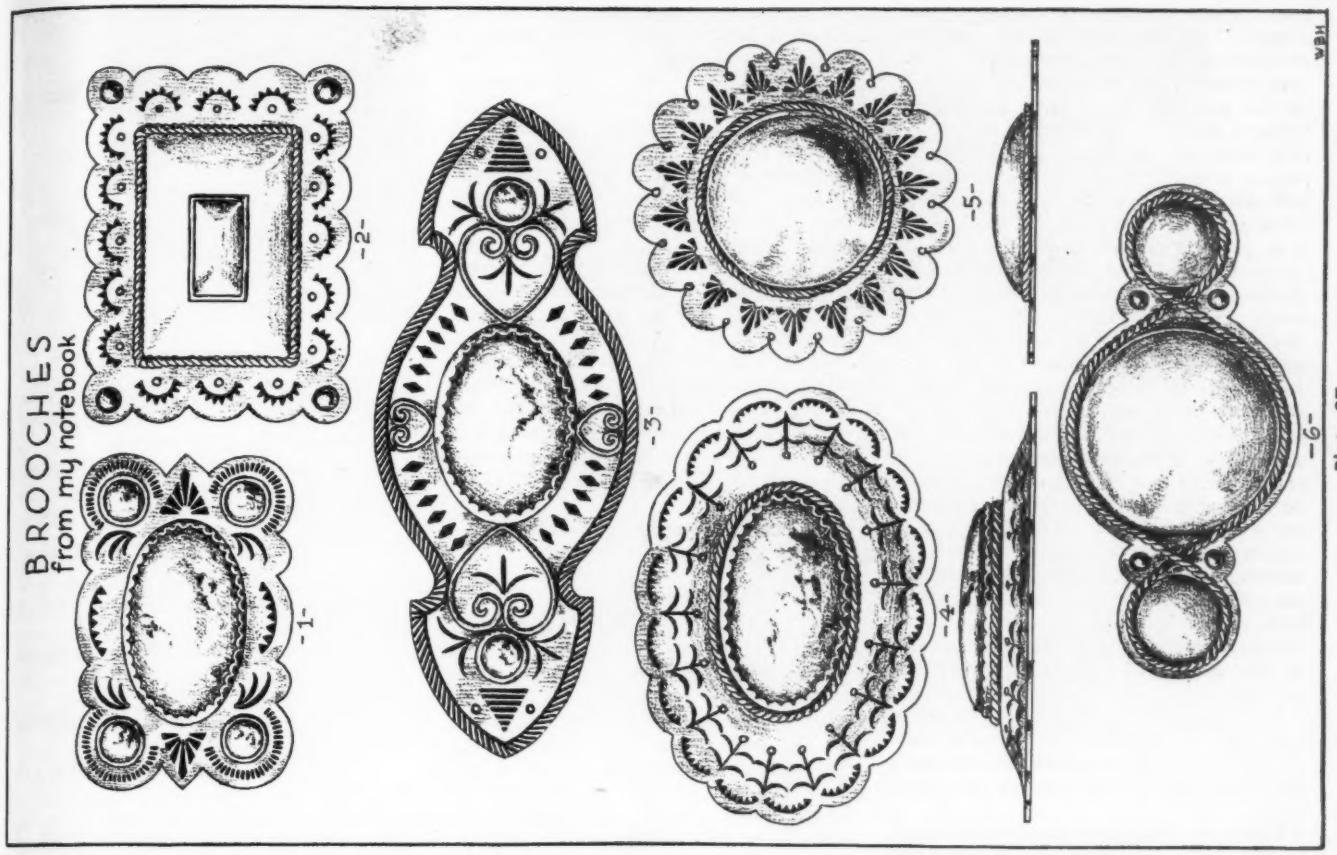
(Continued from page 245 of the June, 1948, issue)

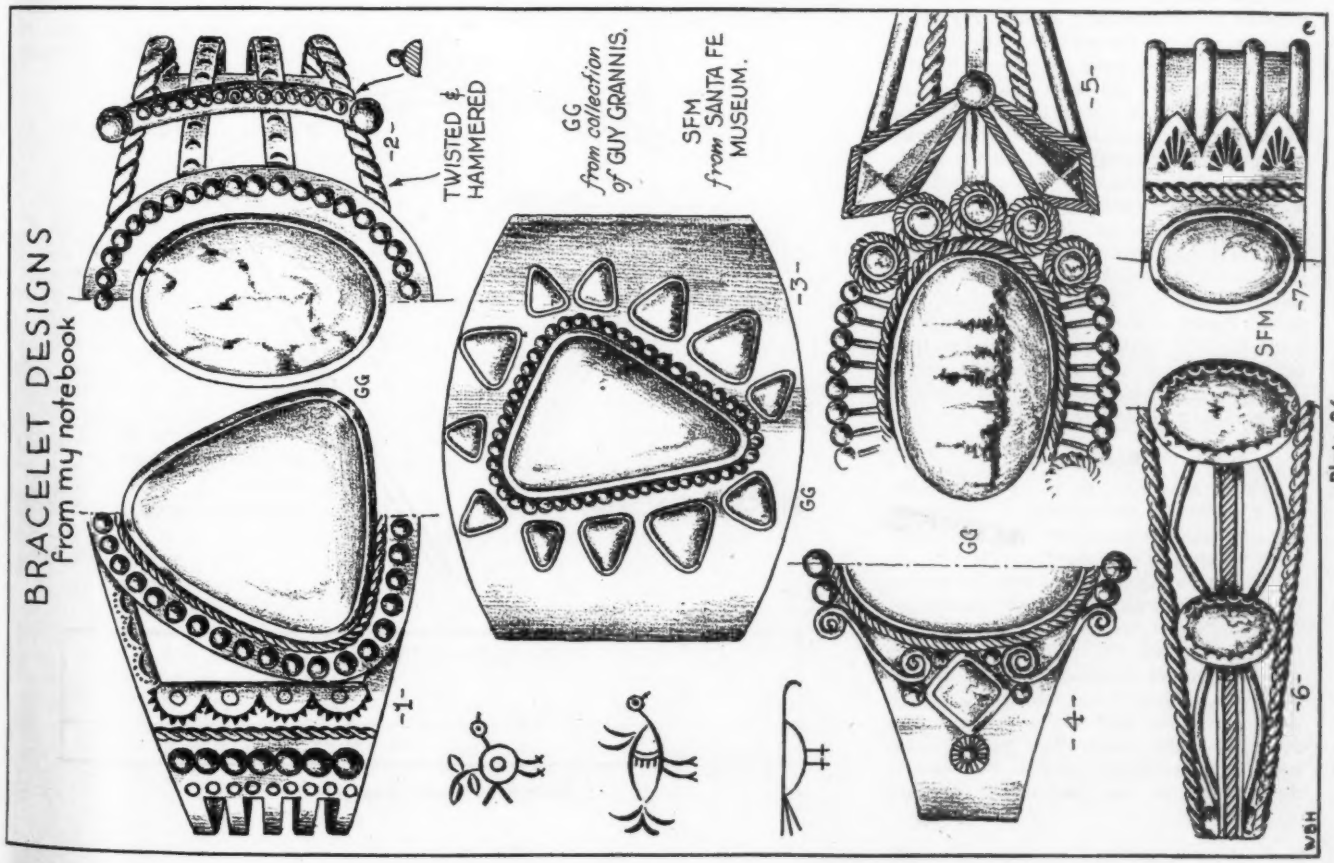
Bracelets

One of the fascinating features of Indian silver jewelry is that while every piece is different, and there are a great many odd shapes and designs, still one can tell at a glance that it is Indian silversmithing. Also, after getting to know the different elements, punch designs, the necessary skill, and the proper materials, it makes a person feel confident that any piece of jewelry can be his or hers for the making.

When traveling through the southwest where there are hundreds and thousands of beautiful pieces of Indian silversmithing on display, one is bewildered at first. After a while, however, only certain pieces will attract one's eye.

If the tourist has a camera along, he can get photographs of the pieces that he admires. But there are times when photographing is out of the question. Then it is necessary to


BROOCHES
from my notebook
-1-
-2-
-3-
-4-
-5-
-6-
WBH
Plate 27


BRACELET DESIGNS
from my notebook
-1-
-2-
TWISTED & HAMMERED
GG
GG from collection of GUY GRANNIS.
SFM from SANTA FE MUSEUM.
-3-
-4-
-5-
-6-
-7-
SFM
WBH
Plate 26

resort to sketching. Now do not say "I can't sketch." Everyone can't be an artist but everyone can take pencil and paper and try. Even if the sketch looks like hen scratches, the one who made it will know what he was trying to depict. If the sketch is not so perfect, notes may be added as an aid to the memory later on. Then when you sit down at your workbench you can make the piece in silver, perhaps better than you could sketch it on paper. You may even remember little things that you could not draw. It is these sketches that will help you make better designs, and do better silverwork, than if you were copying directly what someone else had made. The author's notebook contains many designs that he sketched years ago. Looking over them he can still recall things that are not definitely shown in the sketches. To help other silversmiths, especially beginners, he has redrawn these bracelet designs. Even if the beginner tries to duplicate them, he should try to make changes here and there in order that the finished work is strictly his own. The silversmith should also make sketches of designs of his own and enter them in his notebook. He will be surprised at the progress he will make in sketching as time goes on; also at the number of different ideas he will accumulate.

In Plate 26 it will be noticed that where both sides of a bracelet are identical, only one half of the design is shown in the sketch. This saves time, yet presents all that is required.

Figure 1, Plate 26, shows a two-piece bracelet; that is, the mount or setting is soldered to the bracelet proper. Figure 2, Plate 26, also has the setting soldered to the bracelet. The outer bands on this and the one shown in Figure 5 are of twisted wire, hammered carefully to about one half of the thickness of the original twisted wire. Figure 3 is quite an intriguing design. All the stones are solid blue without any matrix, and the only attempt at ornamentation was the row of raindrops around the large stone. Figure 5, while rather overelaborate, as far as design goes, is an eye catcher with its setting of petrified wood in yellow, orange, black, and purple. Figures 4 and 6 speak for themselves, while Figure 7 needs a little explaining. It is built up on a flat band with the half rounds and the setting, which goes out to the arrow-shaped points, soldered on.

Brooches

Indians, as a rule, do not wear brooches and consequently these pieces of ornamentation are rather scarce, since they are mostly made on order. Those shown on Plate 27 are partly from sketches made of brooches seen in the southwest, and partly from sketches of the author's own design.

Figure 1, Plate 27, is simply a flat base with settings and stampings. Figure 2 has the inner oblong bumped up, a border of twisted wire around the edge and an oblong stone mounted in the center. This brooch might look just as attractive without the stone if the bumping up was done nicely and then polished. Figure 3 has a scalloped bezel and some wire ornamentation added. Figures 4 and 5 are two that were made by the author a short while ago. The brooch shown in Figure 5 was bumped up as shown. It is very beautiful even though no stone was used in making it. Figure 4 is made similar to the one shown on page 384 in the November, 1947, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION. The stamping has been changed somewhat. Figure 6 also is a very attractive brooch. Remember when bumping or doming, that all irregularities must be taken out with a fine file and then the domed piece should be given a high degree of polish before it is soldered to the base. After the twisted wire is soldered around these domes, the amount of polishing required, usually cuts away a lot of the wire, and even then it is impossible to get the edges polished properly.

LUNCH BOX PIE TIN

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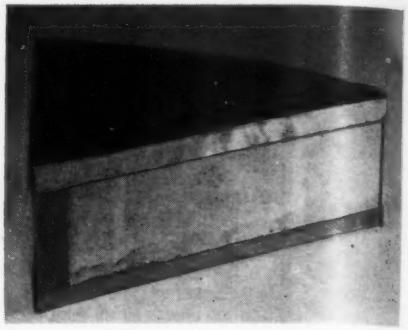
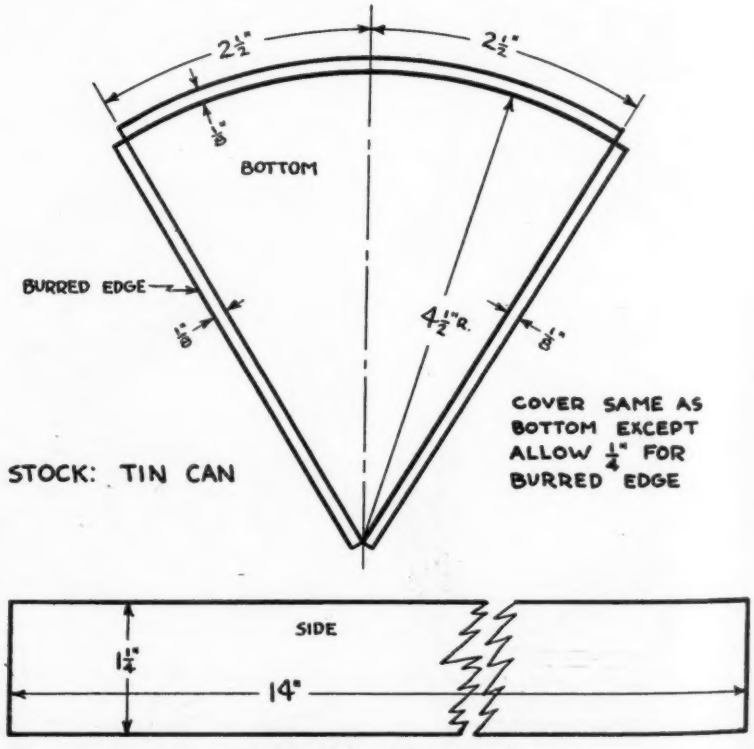
This project grew out of the need for a suitable container for a *pie* lunch as several boys planned an afternoon hike and fishing trip. This job is unique in a number of ways: it is small; it is convenient to carry in the pocket; it holds a wedge of pie and keeps it fresh, and it furnishes the student with a novel project. The following order of procedure is set down merely as a skeleton guide for the boy, and is not intended as a substitute for the instructor's demonstration.



Lunch box pie tin

1. Get out bottom, cover, and side stock (tin cans, tin snips).
2. Lay out all parts (combination square, scriber, dividers).
3. Cut out and notch all parts (tin snips).
4. Make two hardwood forms of ¾-in. maple the shape of the bottom over which to fold up the burrs.
5. Clamp bottom stock between forms and bend burrs (C clamp, vise, mallet).
6. Form side to fit bottom.
7. Solder side to bottom (solder, soldering copper).
8. Clamp top stock between forms and bend burrs.
9. Fit cover to body (pliers).
10. Polish carefully over all (steel wool).



Details of lunch box pie tin

FURNACE FOR MELTING NONFERROUS METALS

HARVEY SUMMERS
Industrial-Arts Instructor
Jefferson High School
Portland, Ore.

In recent years more industrial-arts teachers have added metal casting to the list of experiences offered in the shop curriculum. No other experience is more thrilling and fascinating to the student than the melting and pouring of metal. Not only can some of the fundamental skills be developed, but the casting unit offers rich correlations with mathematics, science, and the study of industrial procedures. Aluminum and many of the other light metals have come into greater industrial use during the war. Many worth-while projects can be made from these nonferrous metals. If the student follows through from pattern-making to the finished product, the experience is one which will touch on many industrial processes.

Many shops have not been able to install the metal casting unit because of the expense involved in obtaining a melting furnace. The furnace described in this article is one which has proved very satisfactory for melting aluminum, brass, and other similar metals. It can be built with a minimum of expense and should prove a valuable addition to any industrial-arts shop.

The furnace described herewith has a capacity of about ten pounds of aluminum. This amount would be sufficient for most home or school shops; however, the size may be varied, either larger or smaller to suit almost any need.

— Photo, Dept. of Visual Education, Portland Public Schools
Melting furnace

Materials Needed

I. For the furnace
- A. Small oil drum 16 in. in diameter
- B. 150 pounds of castable refractory cement that will stand about 2500° F.
- C. 18 feet of ⅛ by 1-in band iron
- D. 2 pieces of ¼ by 1¼ by 12-in. band iron
- E. 6 stove bolts ¼ by 2 in.
- F. 2 small turnbuckles
- G. 4 feet of 3/16-in. round iron rod (or heavy wire)
- H. 10 feet of stove pipe wire
- I. 1 piece of light sheet metal 13 by 36 in.
- J. 1 piece of light sheet metal 3 by 24 in.
- K. 3 — 10-in. disks of ¼-in. plywood
- L. 2 — 6-in. disks of ¼-in. plywood
- M. Pipe fittings as follows:
  1. 1 — 1-in. pipe plug
  2. 3 — 1-in. close nipples
  3. 2 — 1 by 2-in. nipples
  4. 1 — 1 by 3-in. nipple
  5. 1 — 1 by 4-in. nipple
  6. 1 — 1 by 6-in. pipe (threaded on 1 end)
  7. 1 — 1 by 20-in. pipe (threaded on 1 end)
  8. 1 — 1 by 6-in. pipe (no threads) (6, 7, and 8 may be 1 piece 32 in. long, threaded both ends, cut up into the pieces mentioned)
  9. 3 — 1-in. tees
  10. 2 — 1-in. ells
  11. 1 — 1-in. cross tee
  12. 2 — 1 by ½-in. cross tees

II. For the burner
- A. 1 stainless steel disk 2 in. diameter and ¾ in. thick
- B. 2 pieces 2-in. pipe 6 in. long (or longer) threaded on 1 end (This may be a piece threaded on both ends, cut to required size)
- C. 1 piece ½-in. pipe 12 in. long (threaded on 1 end)
- D. 1 — ½-in. shutoff valve or gas cock
- E. 1 — 2 by 2 by ¾-in. reducing tee

III. A blower capable of supplying air at about 3" pressure. It may be a vacuum cleaner, blacksmith's blower or a home-made centrifugal type blower.

Procedure

I. Preparation for pouring cement (lining furnace and casting lid).

A. Make three 10-in. disks of ¼-in. plywood, cut them in half making 6 semicircles. Nail 3 of these together as shown in Figure 1, so that each one overlaps the one below it 60 deg., making a laminated disk 10 in. in diameter. Two of these disks are required.

B. Use these disks for spreaders for the inner form of the main body of the furnace. Wrap a piece of thin sheet metal 13 in. wide and 36 in. long around these disks and tie it in place with bands of stove pipe wire. See Figure 2. The plywood disks are laminated so they may be easily torn apart for removal after the cement is set.

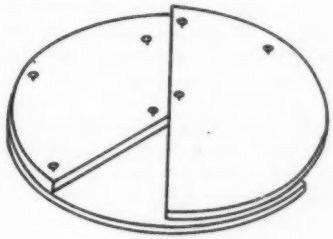


Fig. 1

C. Make another core with solid 6-in. plywood disks and a piece of thin sheet metal 3 in. wide and 24 in. long as in Figure 3. This form will be used to make the hole in the furnace lid.

D. Cut the oil drum down to 16 in. depth

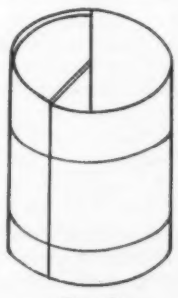


Fig. 2

for the body of the furnace and cut a 3-in. diameter hole through the side with its center 7 in. from the bottom. This will be the orifice for the burner.

E. Cut a 3-in. ring from the part of the drum removed in step D. This will be the outside ring for the lid. See Figure 4.

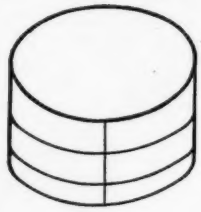


Fig. 3

F. Lay the ring on a board and nail blocks around the outside to keep it from spreading out of shape when the cement is puddled. Place the 6-in. core, Figure 3, in the center of the ring and weight it down so that it will not float when the cement is poured in the mold. See Figure 4.

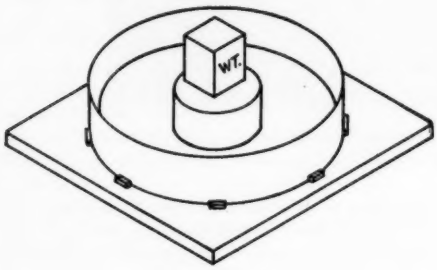


Fig. 4

G. Make a tapered wooden plug 4 in. long, 2½ in. in diameter at the small end and 4 in. in diameter at the large end.

II. Pouring Cement.

A. Mix the refractory cement according to the directions given by the manufacturer of the kind of cement you are using and fill the lid form shown in Figure 4.

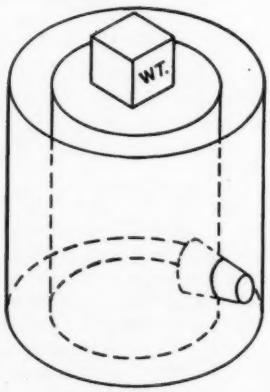


Fig. 5

B. Pour a 3-in. layer of cement in the bottom of the oil drum. Smooth or "float" the surfaces according to the directions given for your cement. Some kinds should not be troweled because it tends to separate the ingredients.

C. Before the cement in the bottom of the drum is set, place the larger core, Figure 2, in the center of the body and weight it down so it will not float. Put the wooden plug (Step G, in Section 1) in the orifice hole with the little end out and the big end against the core. See Figure 5. Finish filling the mold, smooth the top and allow the cement to set according to the manufacturer's directions.

D. Remove the cores by tearing apart the wooden frames and collapsing the sheet metal, being careful not to crack the cement. Remove the tapered plug by driving it inward.

III. Mechanism for Lifting the Lid.

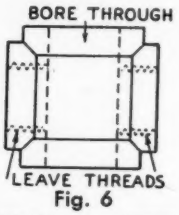


Fig. 6

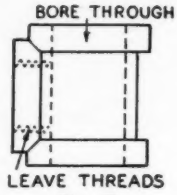


Fig. 7

Fig. 8

A. Bore out 2 ends of the cross tee so it will fit loosely over a 1-in. pipe. See Figure 6. The easiest way to do this is to chuck up the tee in a lathe and use a boring bar.

B. Bore out 2 ends of 2 of the tees in the same way (Fig. 7). Bore out only 1 end of the third tee and put a 1-in. pipe plug in the other end, as shown in Figure 8.

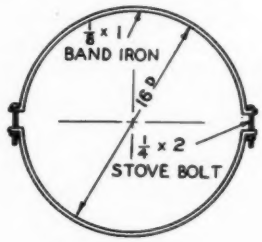


Fig. 9

C. Make three, 2-piece circular bands out of ⅛ by 1-in. band iron with the ends bent out and bored for ¼-in. stove bolts so they may be clamped around the furnace and the lid, as shown in Figure 9.

D. Weld a close nipple to one half of each of these bands, as shown in Figure 10.

E. Assemble the fittings as shown in Figure 11. The tee (1) and the cross tee (9) slide or turn freely on pipe (12) and (14) respectively. (10) is a close nipple welded to the lid band (11). (16) and (19) are close nipples welded to the body bands (17) and (20). The

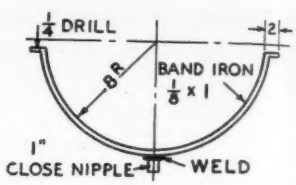


Fig. 10

tees (15) and (18) allow the pipe (14) to turn in them and the plug (21) supports the weight of the entire assembly.

F. Fasten the entire assembly to the furnace and lid by bolting the bands (11) around the lid, (17) and (20) around the furnace.

G. Bend a piece of 3/16-in. rod around the upper fork in the top tee and make hooks at the ends to attach to 2 turnbuckles. From the other ends of the turnbuckles run rods to the joints in the lid band. See Figure 12. This adjustable brace supports the weights of the lid.

H. Bend offsets in two pieces of ¼ by 1¼-in. band iron and weld them to a 6-in. length of 1-in. pipe to form a fork that will fit over the two 1 by ½-in. cross tees, parts 5 and 13 in Figure 11. Drill 2 — ½-in. holes

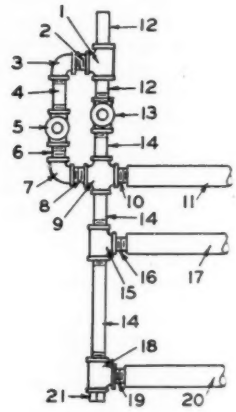


Fig. 11

through the fork, properly spaced so ½-in. pins may be passed through the holes and the cross tees, making a lever. See Figure 13.

IV. Making the Burner.

This type of nozzle mix burner was developed in the laboratories of the Portland Gas and Coke Company, Portland, Ore., to operate on illuminating gas and low pressure air. It is highly efficient and economical and will, under favorable conditions, develop up to 2500° F. It is simple to operate and the air and gas mixture is not "critical." It will never "backfire" or "pop out." The Portland Gas and Coke Company Laboratories have worked out a table of specifications (drawing No. 1739) for this type of burner ranging in nozzle size from 1 to 4 in., using standard pipe sizes and consuming from 35 to 1000 cu. ft. of gas per hour. The burner described here is rated at 130 cu. ft. and costs from 10 cents to 15 cents to melt 10 pounds of aluminum and from 35 to 50 minutes for 5

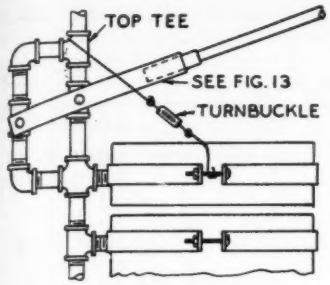


Fig. 12

pounds of brass. The burner consists of two pieces of 2-in. pipe (any convenient length), a 2 by 2 by ¾-in. reducing tee, a length of ½-in. pipe, a gas cock and a stainless steel

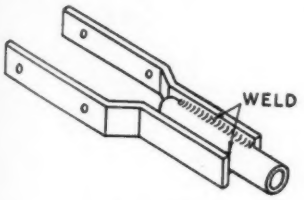


Fig. 13

nozzle. See Figure 14. The amount of air may be adjusted either with a butterfly arrangement in the air pipe or by regulating the speed of the blower. A good plan is to use a V-belt driven blower and experiment with different combinations of pulleys to give the

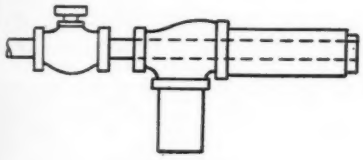


Fig. 14

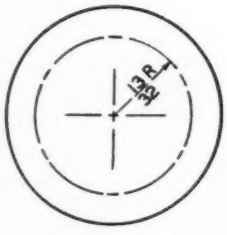


Fig. 15

correct amount of air when the gas is wide open. This plan will be successful *only* if the gas pressure in your area is fairly uniform.

A. Make a disk of stainless steel 2 in. in diameter and ¾ in. thick.

B. Locate the center and scribe a circle with a radius of $1\frac{3}{32}$ in.

C. With the same radius, step off equal spaces around the circle just scribed, as shown in Figure 15.

D. Center punch these points and using them as centers scribe six circles ⅜ in. in diameter. These are the layouts for the ⅜-in. air orifices shown in Figure 16.

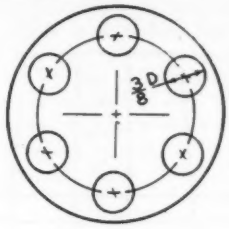


Fig. 16

E. Draw 6 radial lines, each tangent to one of the ⅜-in. circles. See Figure 17.

F. With a square continue these radial lines down the sides of the disks. Center punch the middle points of these lines, as shown in Figure 18.

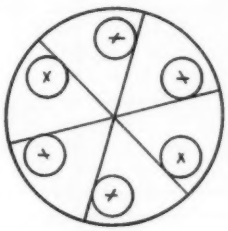


Fig. 17

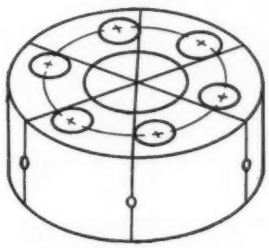


Fig. 18

G. At the center of the disk, drill a ⅞-in. hole as deep as possible without allowing the point of the drill to break through.

H. Drill 6 radial holes $\frac{5}{32}$ in. in diameter at the center punch marks around the edge of the disk. These holes connect with the ⅞-in. hole in the center of the disk. It is important that these holes be radial so the center line of the hole will be tangent to the ⅜-in. air orifices (Fig. 19).

I. Drill the 6 jet holes ⅜ in. in diameter through the disk. *Important!* The $\frac{5}{32}$-in. radial holes must be drilled *before* the jet holes are drilled.

J. Plug the outer ends of the radial holes. To do this tap the holes $\frac{3}{16}$-in. — 32 and insert a short stud, peening it to prevent leakage. Or the holes may be welded shut.

The gas enters the ⅞-in. hole (Fig. 19) and passes through the radial holes and enters the air orifices at a tangent. This tangential entry causes a whirling motion which mixes the gas thoroughly with the air producing 6 jets of blue flame.

K. Assemble the torch as shown in Figure 14. First weld the ½-in. pipe in the ⅞-in. hole in the disk. Then weld the disk into the 2-in. pipe. Finally weld the ½-in. pipe to the reducing tee.

Now the furnace is complete except for connecting to the gas and air supply and setting up the burner and furnace in their proper relations to each other. Much of this depends on local circumstances and is left to the ingenuity of the reader. The burner should enter the furnace at a *slight* angle to the radius. The jets should strike the crucible at a slight angle but not quite tangent to it. If the deviation from a radial line is too great, the heat tends to concentrate on heating the walls of the furnace instead of the crucible. If the deviation is too little the heat is not evenly distributed over the crucible but heats it in one spot. A little experimentation will determine the correct angle.

The nozzle of the burner does not need to be inside the hole in the furnace. If it is placed just even with, or just entering the hole, the venturi action will suck in additional air which will cool the nozzle and at the same time supply more air for combustion, thus cutting down the amount required from the blower.

Sometimes the crucible may stick in the furnace due to the formation of slag from some kinds of cement. To overcome this difficulty, put about a ½-in. layer of silica sand in the furnace. Some of it will be blown out but enough will remain to prevent the crucible from sticking.

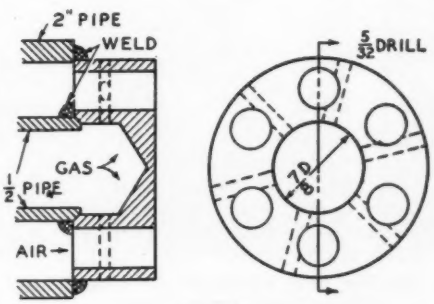


Fig. 19

"UNFINISHED RAINBOWS" — A REVIEW

GEORGE M. PURVIS
Instructor in Metalworking
Ventura Junior High School
Ventura, Calif.

This review of an interesting film is presented with the hope that other instructors may use this fine teaching aid.

Standing informally about a laboratory table an earnest science teacher discusses with his class the impact of science on everyday life. His subject for this lesson is the development of aluminum and the narrative carries us back to the days of Napoleon III when aluminum was more valuable than gold and silver. Its price at that time was $545 per lb.

Napoleon was interested in aluminum because of the possibility of improving the mobility of his artillery by using the lightweight

metal. Continued experiments did reduce the price of the metal, but by 1885 it was still worth $8 a pound, which was a prohibitive price for all practical purposes.

In that year, however, Charles Hall, just out of college, becomes imbued with the idea of refining aluminum by the electrical method. After many discouraging failures he finally proves his theory correct. But his battle is only begun. Setting up a practical method of manufacturing aluminum, securing financial backing, and finally convincing others to use it, are the component parts of a really intriguing drama.

This is undoubtedly one of the best of the new pictures for the metalworking classes. It is not only interesting and exciting, but it carries a stimulating message throughout the picture that is put into these words with the instructor's closing remarks: "There are so many things in this world just waiting to be done. What are you going to do about it?"

The picture is available from Alcoa Motion Pictures, 801 Gulf Bldg., Pittsburgh 19, Pa. Technicolor, sound, time, 35 min., transportation charges only.

INDUSTRIAL-ARTS GUIDANCE

WILLIAM H. BOWERS
Tuckahoe High School
Tuckahoe, N. Y.

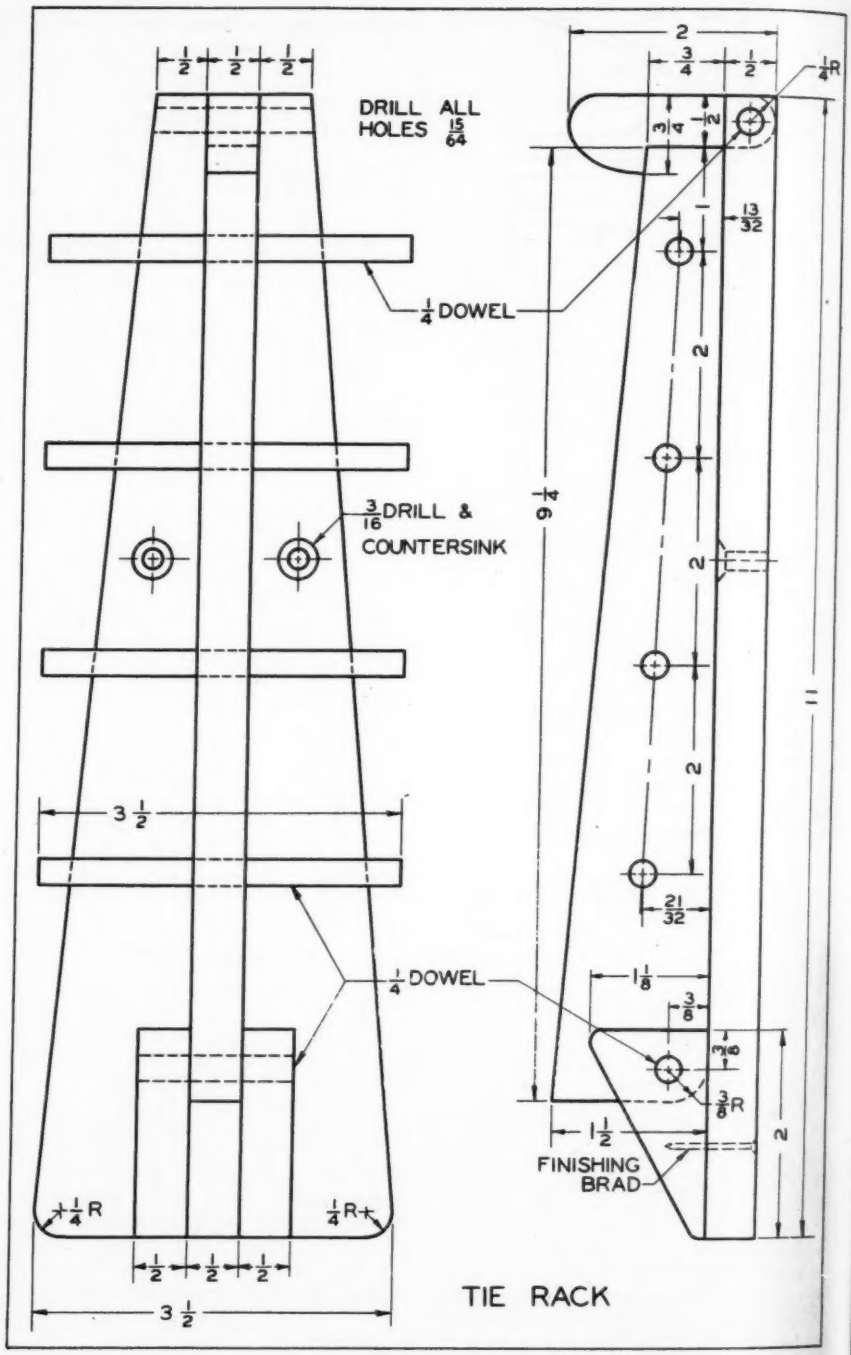
The teaching of industrial arts and mechanical drafting is one of the greatest vocations in this world. The writer will begin his twenty-eighth year as a teacher and supervisor this September, and feels today as he did in September, 1920, that he is in the right profession.

The feature of teaching that intrigues him most is that it gives him an opportunity of being of service to others. The majority of his boys have come from "the other side of the railroad tracks," sons of recent immigrants to the United States, boys with small chance or thought of ever entering college.

It is the writer's belief that the shop teacher, due to individual instruction and daily contacts with his group, occupies a preeminent position, as a guidance factor, in a senior high school faculty. His influence can be directed toward orienting a student into the niche in life that will make him a satisfied and useful citizen in the years to come.

In 1936, one of his industrial-arts boys expressed the desire to become a shop teacher to the writer. This boy was graduated from Oswego Teachers College, Oswego, N. Y., a few years later, and has been teaching industrial arts since in West Virginia. He is an excellent teacher and is now happily married.

Since then, scouting for industrial-arts teacher talent has been the writer's steady aim. In the past several years it has been his custom to arrange an industrial-arts and mechanical drafting guidance display on a bulletin board, on the first floor of our school, adjacent to the superintendent's office. The contents of facts, photos, and pertinent guidance matters is changed each Monday morning. This display is made as interesting and attractive as is possible.



Novel tie rack, designed by Wallace Appleyard, Yeadon, Delaware County, Pa.

Pertinent guidance topics are assigned weekly in the senior high school classes for one entire semester. A neat notebook is prepared by the student and graded by the instructor twice during the term. At the present, definite results are as follows:

Seven of our former industrial-arts graduates are today training to be shop teachers at Oswego Teachers College. One of these young men was a navigator in the recent war. He is a senior this year. He and another young man rated in the upper 20 per cent when school ended in June, 1947. The other boy, a colored youth, is doing well in his schoolwork and is one of the most popular fellows at the college. In January, 1947, two

more boys departed from Tuckahoe to begin their work at Oswego. Both are excellent industrial-arts teacher material.

A few years hence these young men will be out teaching industrial arts and mechanical drafting, perhaps influencing their students to embark upon a life in which they can be of "service to others."

THE EFFICIENT USE OF CUTTING FLUIDS

R. M. DYKE
Vancouver, B. C., Canada

Part I — How to Use Soluble Oils

The great variety of cutting fluids now available, and the efficiency resulting from their proper use, make these requisites to good machining well worth some extra attention.

Modern high-speed machining operations and the close tolerances now demanded make the use of a cutting fluid a *must* in metal-working production. In the school machine or metal shop, the proper applications of these fluids will also prepare the student for the commercial practices he will encounter later.

The advantages to be derived from proper coolant selection are often overlooked, however. The possibilities of the newer coolants, in particular, are seldom fully exploited, and none of them need be confined to production work only. In the school shop, a coolant used for finishing cuts on steels, for example, will result in more accurate dimensions and make the common polishing operations unnecessary in very many cases.

Cutting fluid selection begins by dividing the commercial types into two main groups: *soluble* oils and the *straight* cutting oils. They may be regarded as coolants and lubricants, respectively, although these functions overlap.

Soluble oils have by far the widest use, and will be discussed first. They should be employed where cooling is the primary function as with light and medium cuts. The straight oil types, however, have lubricating as the foremost function, as with the harder steels, or heavy cuts at slower speeds. Terms like coolant, cutting compound, and cutting fluid are applied in a general way and do not denote any particular type.

Functions of Coolants

Aside from improving the surface finish, prolonging tool life, and affording greater dimensional accuracy, cutting fluids also have these additional functions to perform: (1) To cool the cutting tool and work, which prevents distortion of the work from the heat of machining and avoids softening of the cutting edge. (2) To lubricate the cutting tool, and reduce the friction on the tool face when heavy chips are removed. (3) To make higher cutting speeds possible. (4) To reduce the power required for machining, and in some cases to lubricate certain parts of the machine as well. (5) To prevent rusting or corrosion of the finished parts and machine, and to wash away the chips, especially in grinding.

Modern cutting fluids also contain a germicide for prevention of bacterial development. They must also be odorless, possess stability under heat, must not foam, and must be fairly transparent.

What Soluble Oils Are

Soluble oils are the most versatile of all cutting fluids, and are relatively cheap, since they are mixed with water. Water alone, however, although having a high cooling rate, is objectionable, because it is not a rust preventer.

Soluble oils are not actually soluble, but form a milky white emulsion when mixed with from 7 to 100 parts of water by volume. They serve primarily as cooling agents, the oil content providing some lubrication and corrosion protection at the same time.

These oils consist of a mixture of mineral oil, a fatty oil, and an emulsifying agent such as soap. The fatty oil can be vegetable or animal type, such as lard, or a synthetic fatty oil. Other things are then included to produce special effects. These oils are proprietary or patented compounds, and resemble lubricating oils in general appearance, before being mixed with water.

Soluble Oil Types

A variety of soluble oils are now available, to take care of various requirements. They come in both the liquid and paste forms, the former predominating. In addition to usual grades, special types are also available.

The heavy-duty type is intended to replace straight cutting oils in some cases for severe operations, as in heavy drilling, hobbing, and heavy milling. The advantages of special transparent soluble oils are obvious.

A special soluble grinding oil also is on the market, although the common type is still frequently employed for grinding. Some soluble oils feature improved germicides and detergents. Early soluble oils consisted mostly of an oil added to soda water. In some cases the ingredients are boiled for varying periods to produce a saponified emulsion.

The cooling rate of the common soluble oil

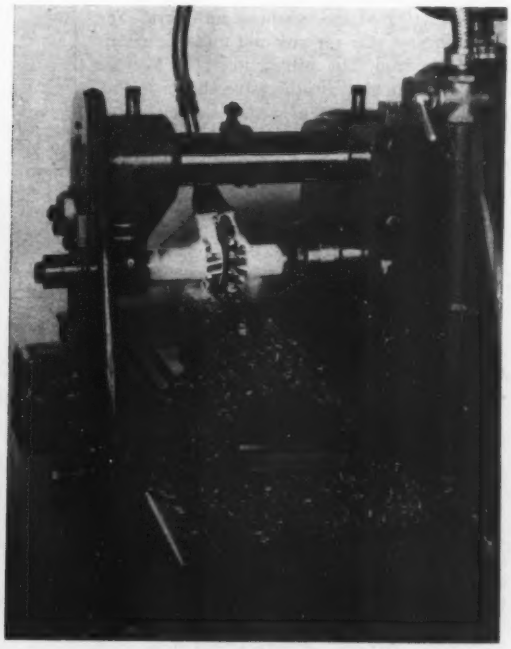


Fig. 1. (Left) Soluble oils speed up lathe operations, and produce more accurate work and better finish. Photograph, courtesy of American Tool Works Company. Fig. 2. (Right) Chip removal at high cutting rates requires a copious flow of coolant. Flat nozzles give wide coverage. Photograph, courtesy of Brown and Sharpe Mfg. Co.

grades is impaired when the temperature of the coolant rises above the boiling point of water. For this reason, in severe applications, as in very heavy cuts, on the harder tool and alloy steels, the straight cutting oils must be used.

How to Mix Soluble Oil and Water

If the emulsion is made richer than 7 parts of water to 1 of oil, there is danger that an *inverted* emulsion will be formed, which produces an unsatisfactory, muddy mixture of water in oil, instead of a proper emulsion of oil in water.

Always add the oil to the water. Medium stirring should be employed, and the water must not be below normal temperature.

The richness of the mixture depends on the severity of the operation and the hardness of the metal; more water can be used for light

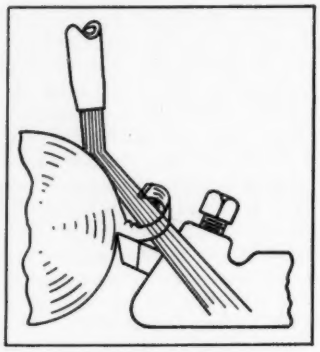


Fig. 3. Poorly placed nozzle. Coolant should hit tool

cuts, such as in grinding, but the coolant should not be thinned to the extent that it causes rusting of the machine and work. The most efficient *mix* for any job must be determined by trial, but proportions for average conditions are given in the table shown in Figure 4. Twenty parts of water to one of oil will do for general use.

Parts of water to 1 part of soluble oil, for soluble, oil-water mixtures (emulsions).

Turning and boring	15– 30
Drilling	25– 50
Sawing	20– 40
Grinding	30–100
Milling	10– 30
Broaching	7– 15

(Shaping and planing is done dry in most cases.)

Fig. 4. Dilution table

A "base mix," a rich mixture of 7 to 10 parts of water to 1 of oil, is convenient and saves much time in the shop, water being added later as required, to obtain any desired ratio.

If the water is especially hard, it must be heated or a water softener added first (such as soda ash, under 1 per cent by weight), to produce a stable emulsion. Some oils contain an agent which makes this unnecessary.

The mixture should be tested at regular intervals for proper oil-water ratio. The Gulf Oil Corporation recommends the procedure shown in Figure 6: "Put 100 cc. of emulsion in graduated cylinder. Add a few drops of hydrochloric acid (HCl), agitate, then allow to settle. When the oil and water have separated, read on the graduated scale the number of cc. of oil in the cylinder. This represents the per cent of soluble oil in the emulsion."

Any glass vessel or bottle with parallel sides would do for this instead, then measuring the original height of the contents with a rule, also the amount of oil separated, and computing the percentage. See Figure 5.

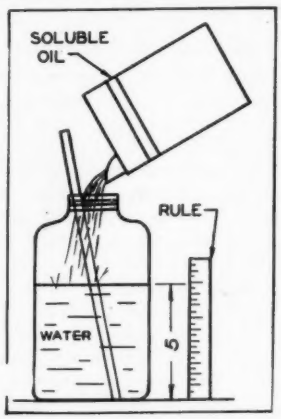


Fig. 5. To prepare a small quantity of 20: 1 mixture, add ¼ in. of soluble oil to 5 in. of water. Always pour the oil into the water. Stir gently

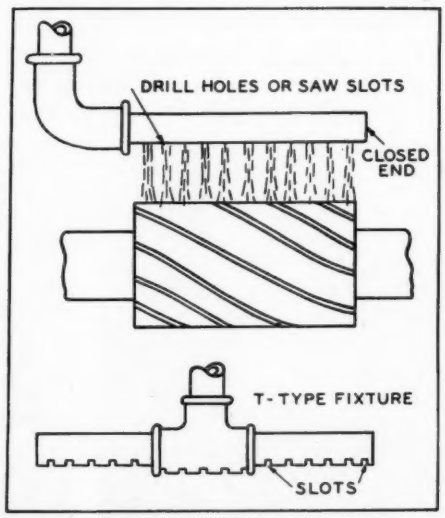


Fig. 7. Shop-made nozzles which cover wide areas efficiently

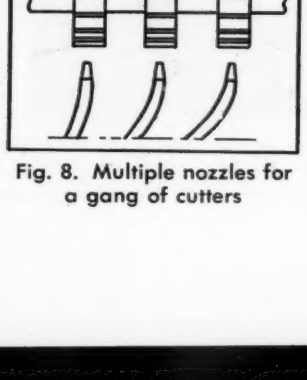


Fig. 8. Multiple nozzles for a gang of cutters

Acidity developing in an emulsion will cause separation. This should be tested with blue litmus paper, which turns red if acidity is present. The acid condition can be corrected by the addition of sodium carbonate (soda ash), to restore the alkaline state.

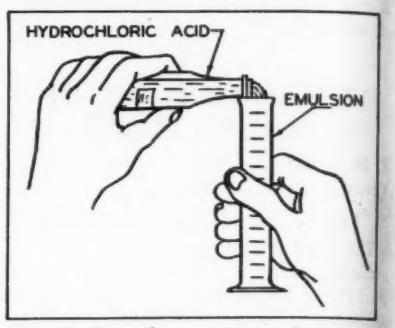


Fig. 6. Test the per cent of soluble oil in the mixture, or emulsion, by separating the oil from the water

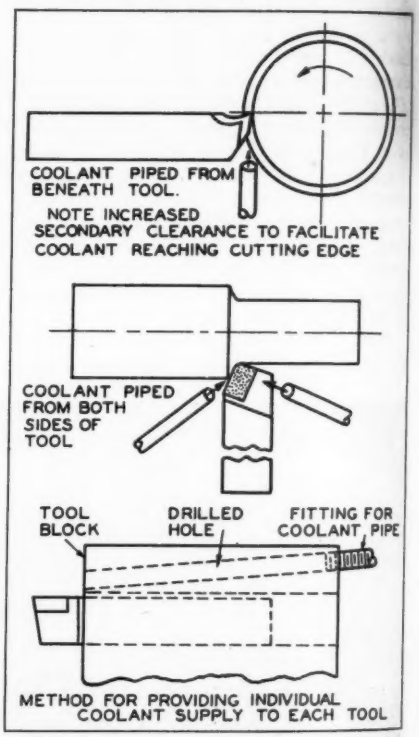

COOLANT PIPED FROM BENEATH TOOL.
NOTE INCREASED SECONDARY CLEARANCE TO FACILITATE COOLANT REACHING CUTTING EDGE
COOLANT PIPED FROM BOTH SIDES OF TOOL
TOOL BLOCK
DRILLED HOLE
FITTING FOR COOLANT PIPE
METHOD FOR PROVIDING INDIVIDUAL COOLANT SUPPLY TO EACH TOOL

Fig. 9. How to apply coolant to carbide tools as recommended by Carboloy Co.

Applying the Coolant

A built-in pump and circulating system on each machine requiring coolant is a preferred method for production runs. Where a special mixture or coolant is required for short runs, it is usually an easy matter to improvise a simple gravity system. A central system, which supplies all machines in the shop through piping, is favored in some shops.

Fig. 10. (Left) Coolants are important on precision grinding jobs. Fig. 11. (Right) High turret lathe output and reduction of tool grinding are achieved by using soluble oil coolants. Photographs, courtesy of Gulf Oil Corporation

Nozzle construction is also important. Refer to Figures 7 and 8, also Figures 1, 2, 10, and 11. Special methods of applying coolant to carbide tools are shown in Figure 9. Soluble oils are usually preferred to other cutting fluids for carbides, when not used dry.

The coolant must be kept free from contamination at all times. In cylindrical and surface grinding, the coolant must be changed oftener than on other machines. Some of the smaller particles ground off do not settle out but remain in suspension, causing fine scratches on the work.

Special Cases

On magnesium, water-bearing compounds *should never be used,* as they increase the fire hazard greatly, and straight cutting oils should be used instead. Soluble oils are extensively used for aluminum machining, however.

On automatic screw machines, straight oils are preferred, such as straight mineral oils, which will not affect the machine bearings. Cast irons, of course, are worked dry in most cases, also cast brass and bronze. These metals may be tapped, however, with a small amount of straight cutting oil, like the mineral-lard oil type.

Soluble oils of different types should not be mixed, as the additives may not be similar. Do not employ too small a flow of coolant, as insufficient coolant directed on a hot tool can do more harm than good, as far as the cutting tool is concerned.

The proper application of soluble oils will be reflected by better work, reduced downtime for cutting tools, increased output and time saved throughout.

WOODWORKING BENCH VISE

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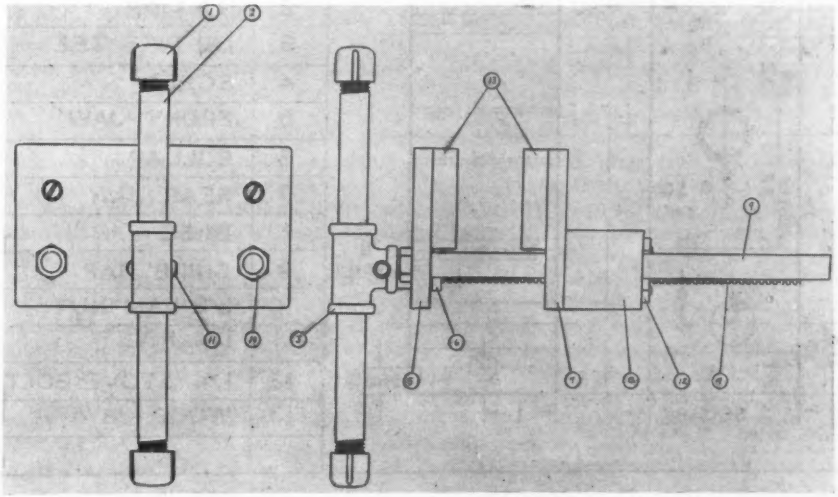
Schools without foundry facilities are often handicapped in their selection of projects for the machine shop because most of the more advanced projects require castings. The woodworking vise shown herewith may be made entirely of cold rolled steel and pipe fittings. The completed vise is a useful and valuable piece of equipment, which will be welcome in any home shop.

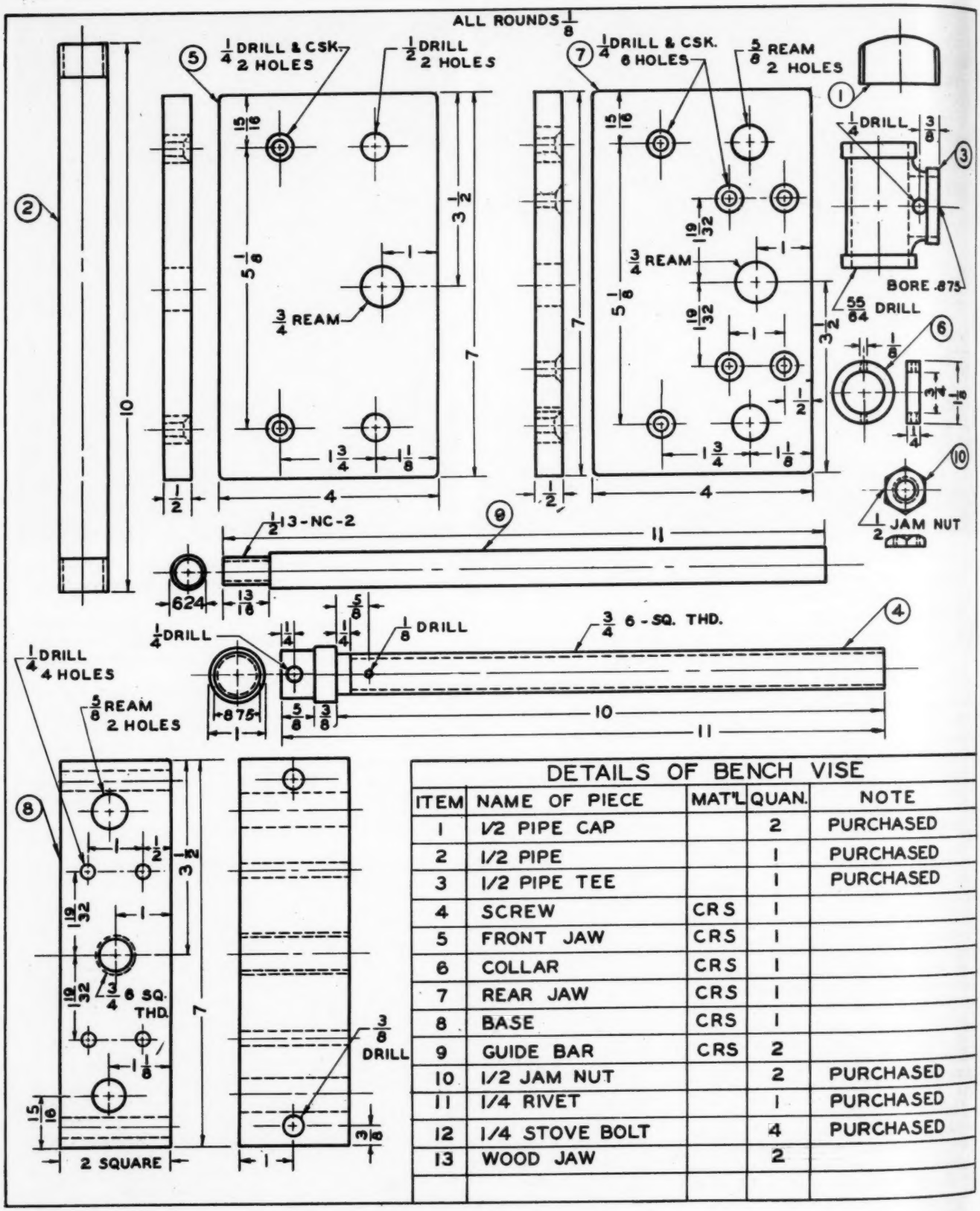
This project offers an opportunity for practice in several fundamental machine operations, such as drilling, boring, reaming, cutting internal and external square threads, shaper, and layout work.

If the work is carefully done there should be little difficulty encountered in the construction and assembly.

Care must be taken in the layout, drilling,



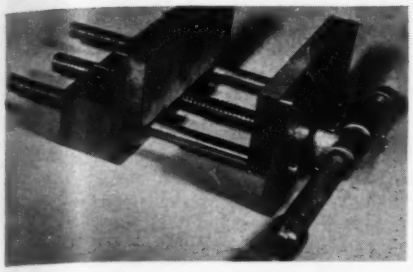
Assembly of woodworking bench vise



DETAILS OF BENCH VISE

ITEM	NAME OF PIECE	MAT'L	QUAN.	NOTE
1	1/2 PIPE CAP		2	PURCHASED
2	1/2 PIPE		1	PURCHASED
3	1/2 PIPE TEE		1	PURCHASED
4	SCREW	CRS	1	
5	FRONT JAW	CRS	1	
6	COLLAR	CRS	1	
7	REAR JAW	CRS	1	
8	BASE	CRS	1	
9	GUIDE BAR	CRS	2	
10	1/2 JAM NUT		2	PURCHASED
11	1/4 RIVET		1	PURCHASED
12	1/4 STOVE BOLT		4	PURCHASED
13	WOOD JAW		2	

Details of woodworking bench vise



Woodworking bench vise

and reaming for the screw and guides. We have found the following procedure helpful in eliminating the danger of misalignment of these parts:

1. Make the vise screw, piece No. 4. The student should be allowed to study the square thread and be assisted with grinding the tool used for cutting this thread.

2. Make the vise base, piece No. 8. Square up the stock and lay out and center punch all holes. Drill ⅜-in. holes. Place piece in four-jaw independent chuck and indicate central hole, true, drill 37/64 and bore to .584. Cut the internal square thread. Check by fitting the screw in place.

3. Layout the front vise jaw, piece No. 5. Place piece No. 7, the back vise jaw, under No. 5 in the drill press, and drill and ream the central hole in both pieces.

4. Assemble back jaw and base and draw tight together with vise screw. Drill ¼-in. holes through both pieces and countersink in face of jaw. Put ¼ by 3-in. stove bolts in place. Remove screw.

5. Assemble both jaws, base, and screw. Drill ½-in. holes through entire assembly. Remove screw and front jaw. Redrill and ream the guide holes in back jaw and base assembly to ⅝ in.

6. Drill and countersink the upper ¼-in. holes in jaws.

7. Cut the guide bars, pieces No. 9, from ⅝-in. cold rolled steel. Place in four-jaw independent chuck, indicate face and center drill each piece. Place between centers, file, and polish to .623, and turn ends to size and chase threads.

8. Place piece No. 3, ½-in. pipe tee in chuck and bore to size.

9. Turn the collar, piece No. 6.

10. Place pipe tee and collar in position on screw, drill pin and rivet holes, and rivet pipe tee in place.

11. Polish all parts and assemble vise. Break corners as shown in drawing.

ELEMENTARY AUTO MECHANICS

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Tulsa, Okla.

(*Continued from page 250 of the June, 1948, issue*)

Assignment Sheet No. 11 — Finding the Firing Order of a Motor

Why this is done: In order to send the spark to each cylinder just as it is ready, it is necessary to know the order in which the different pistons reach firing position.

Procedure:

1. Turn the motor over to identify the valves, and label the exhaust valves with chalk marks on the motor block.

NOTE: Following the order of strokes in a cycle (intake, compression, power, exhaust, intake, compression, etc.) it will be noted the exhaust valve always opens and closes *immediately before* the intake valve operates.

2. Bearing in mind that each pair of valves always controls the closest piston, turn the motor over until the exhaust valve *just closes* for piston No. I, and chalk a figure *1* in a convenient place.

3. Continue to turn the motor over and write down the order in which the exhaust valve *closes* for each of the different pistons.

NOTE: The same results would be obtained, of course, if we had selected intake valves.

Questions:

1. Why is the order of action of a given kind of valve the same as the firing order of the engine?

2. Why not fire an engine 1-2-3-4-1-2-3-4-1-2, etc?

3. Can firing order be determined by watching pistons only? Why?

Text Reference: ....

Assignment Sheet No. 12 — Finding the Compression Ratio of a Motor

Why this is done: In order to know the best grade of fuel and the best operating conditions for a motor, it is necessary to know the compression ratio. This information is sometimes not available in printed form and in such a case must be worked out.

Procedure:

1. Pick an assembled motor with cylinder head in place, and increase exhaust valve clearance so that that valve does not open until the piston has passed bottom dead center on the power stroke.

2. Place the piston at top dead center at the end of compression stroke and remove the spark plug.

NOTE: This method will only apply to motors that have spark plug holes in the highest point of the combustion chamber. (This eliminates overhead valve motors.)

3. Fill the combustion chamber with oil up to the bottom of the spark plug hole, using a graduated measure and keeping an accurate record of the amount of oil required.

4. Move piston to bottom dead center and again fill with oil, keeping a record of the second amount.

5. Since pressure is inversely proportional to volume, the compression ratio is the ratio between the volume in the combustion chamber and cylinder when the piston was at the top and the total volume, when it was at the bottom. The ratio of the quantity of oil used first, to the total quantity used will give these two volumes.

6. Drain the oil through the exhaust port and wipe out the motor.

7. Hand in report of ratio found, with motor number, and quantities of oil used.

Questions:

1. Does pressure increase or decrease with an increased volume?

2. What is the limitation on increasing compression ratios in automobile engines.

3. Why is a high compression ratio more efficient than a low one?

Text Reference: ....

Assignment Sheet No. 13 — Finding Piston Displacement of a Motor

Why this is done: Piston displacement is an important specification of a motor as it is one of the principal factors controlling the amount of gasoline consumption. It is also one of the means of establishing a limit on motor size in racing cars, etc.

Procedure:

1. Select a motor with the head off, but with piston assembly in place.

2. Measure the diameter of the cylinder in inches.

3. Measure the distance from top dead center of the piston to bottom dead center.

4. From the diameter, calculate the area of the base of the cylindrical space by the formula: area equals diameter squared times .7854.

5. Find the volume of the cylinder in cubic inches by the formula: height times area of base.

6. Multiply the piston displacement of one cylinder times the number of cylinders to get the figure for the entire engine.

7. Hand in report of displacement found, with motor number, and all measurements and figures used.

Questions:

1. How can piston displacement affect gasoline consumption?

2. How can an engine be changed from a four-cylinder model to an eight cylinder model and the gasoline consumption be held to the same figure?

3. How could the piston displacement be held the same in a motor when the diameter of the cylinders was reduced?

Text Reference: ....

Assignment Sheet No. 14 — Cleaning Spark Plugs

Why this is done: For efficient operation of any motor, it is necessary to have clean spark plugs with proper gap setting.

Procedure:

1. Remove all plugs from the motor and lay out on the bench.

CAUTION: To avoid breaking other spark plugs with the wrench handle and to avoid twisting out of shape the spark plug being removed, use only a *socket type wrench* of the proper size with a handle long enough to give full control of the wrench at all times.

2. Remove and preserve the spark plug gaskets, replacing any damaged ones.

3. If the plug is of the separable type, place body of plug in vise and remove the packing nut.

4. Clean the porcelain and the plug by washing in gasoline or by scraping and using emery paper if necessary.

5. Reassemble separate type plug, tightening, packing nut.

6. Set spark plug gap to specified clearance, checking with thickness gauge.

CAUTION: Make all gap adjustments by bending the *side* electrode, as bending the center electrode will break the porcelain.

7. Replace plugs and gaskets, drawing them down to a snug fit.

CAUTION: A plug need be screwed in just tight enough to hold compression, which is not nearly as tight as you could pull it with the usual long-handled plug wrench. Too tight a set results in stripped threads in head or on plug, crushed or twisted gasket, or a broken plug.

Questions:

1. How does a dirty spark plug affect motor operation?
2. What would too wide a gap do to a motor operation? Too narrow?
3. Why are spark plug gaskets used?
4. What is meant by a *hot* plug? A *cold* plug?

Text Reference: ....

Assignment Sheet No. 15 — Removing and Replacing Cylinder Heads

Why this is done: To recondition all parts of the motor operating in the combustion chamber, it is necessary to expose that portion of the motor by removing the cylinder head.

Procedure:

1. See that all parts have been removed from the cylinder head.
2. Remove the two bolts holding the ignition conduit in place and lay aside the conduit and wires.
3. Remove the rest of the cylinder bolts.
4. Make certain that nothing is left that would hold the head to the block and lift off the head.

NOTE: Rather than prying the head off and damaging the gasket, turn the motor over with the spark plugs in place. This will force the head up by compression.

5. Lift off the head gasket and *hang it up* where it will not be bent or mashed.
6. Scrape all carbon and other deposits out of the combustion chambers, and see that the flat head surface is clean.
7. When motor is ready, soak head gasket in water a few minutes and place in position on block. Check to see that gasket is on properly and all water jacket holes open.

CAUTION: For head to fit tight and hold compression it is necessary that the surfaces of the block, both sides of the gasket, and the bottom of the head be absolutely clean and free from any lumps of dirt or metal.

8. Place cylinder head carefully in place, keeping gasket lined up properly. Check to see that head fits clear down on all sides.
9. Drop two head bolts in place, and start them through the gasket holes and into the threads.
10. Insert the rest of the head bolts and start them all into the threads, with the ignition conduit in place.
11. Tighten down head bolts gradually, starting with the center bolts and working out to the sides and ends, a few turns at a time until all bolts are tight.

Questions:

1. What would happen if you tried to pry off a head when one bolt had been overlooked?
2. Why soak the head gasket in water when replacing?
3. What would happen if a cylinder head was tightened down with a washer under the gasket?

Text Reference: ....

Assignment No. 16 — Removing and Replacing Manifolds

Why this is done: The manifolds are the connections between the valves and the carburetor or exhaust pipe of an engine. In order to recondition the valves, it is, therefore necessary to remove these manifolds.

Procedure:

1. Check over the best order of procedure for the motor being worked on and select the necessary tools.
2. Examine manifolds to see if nuts must be entirely removed or if manifolds will slip down when nuts are merely loosened.
3. Loosen or remove nuts and lift manifolds off.

CAUTION: Extreme care must be taken to prevent manifolds dropping, as they are cast iron and broken easily.

4. Remove and hang up the gaskets.
5. Examine bolts or studs and nuts and replace any that have damaged threads.
6. Scrape and blow carbon from manifolds and lay aside until time to replace on motor.
7. See that contacting surfaces of manifold gaskets and blocks are clean.
8. Hold the manifolds and gaskets in place and run on two nuts or bolts by hand making sure the gaskets line up with the bolt holes.
9. Run on the rest of the nuts with a speed or box wrench to a loose fit. Then check gasket alignment and see that manifold will fit flat against block at all points.
10. Tighten all nuts fairly tight, drawing the manifolds up to place.

CAUTION: Extreme care must be exercised to avoid drawing up nuts too tight, as the cast iron flanges will break off easily under too much pressure or where manifold does not fit flat against block.

Questions:

1. How many exhaust ports are there in the block? How many intake ports? Why is there a difference?
2. Why does a manifold flange break so easily?
3. How would a leaking exhaust manifold gasket affect engine operation? A leaking intake manifold gasket?

Text Reference: ....

. . . For a teacher to know and to employ one method alone means that some students must fail by reason of his gross incompetence . . . Pupils and course parts vary so greatly that to begin a term in possession of one sole means of approach is to invite failure. — *Homer J. Smith.*

OPPORTUNITIES IN THE PRINTING VOCATIONAL FIELD

LEONARD HIMMELMANN
Central Vocational High School
Cincinnati, Ohio

The following pertinent questions are frequently in the minds of students who are thinking about the printing industry and are endeavoring to make a decision regarding a choice of a vocation for their life's work.

Answers to these questions should be readily available to students through teachers and counselors.

1. Q. What service is rendered to society by workers in this vocational field?

A. Printing makes possible the dissemination of knowledge, the sharing of news, and the advertising of products. This is made possible by means of the publication of books, magazines, and newspapers. Ever since the first published list of books by Fust and Schoeffer (contemporaries of Gutenberg) modern advertising has become an *institution* through the medium of the printing press.

2. Q. Give a brief statement as to the history and expansion of the trade.

A. Printing — the fifth largest industry in the U. S. — has been aptly called, "The Art Preservative of All the Arts." Without printing, other industries would not long survive.

Since the invention of movable type by Gutenberg in 1440, printing has undergone phenomenal changes in automatic production; however, some of the fundamental principles of its inventor are still adhered to. In the past score of years, photography has played a prominent role, and is destined to become even more important as time goes on.

3. Q. What are the main divisions in this field — what are the pay-roll jobs?

I. Composing Room
   1. Layout man
   2. Hand compositor
   3. Linotype, Intertype, Ludlow operator
   4. Monotype keyboard and/or caster operator
   5. Machinist
   6. Proofreader
   7. Copyholder
   8. Make-up man
   9. Stoneman

II. Pressroom
   1. Pressman
      a) Platen
      b) Cylinder
      c) Automatic
      d) Rotary
      e) Offset
      f) Rotogravure
   2. Pressman's assistant
   3. Press feeder

III. Bindery
   1. Cutting-machine operator
   2. Folding-machine operator
   3. Round corner perforating and stitching-machine operator
   4. Collater and gatherer

4. Q. What other pay-roll jobs are closely allied to the jobs listed under question 3?

(Continued on page 24A)

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The Sebastian has every improved feature contributing to higher accuracy, utmost ease of operation, longer service life. Also, many items are supplied as standard equipment, included in basic price of the lathe—*more than with any other lathe of its type.* Among these are apron control, steady rest, threading dial, and two face plates.

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American Steel Foundries

KING MACHINE TOOL DIVISION

CINCINNATI 29, OHIO

Builders of Vertical Boring & Turning Machines and Sebastian Lathes

(Continued from page 298)

A. The following allied trades:

1. Stereotyping
2. Electrotyping
3. Photoengraving
4. Rotogravure
5. Lithography
6. Type metal manufacturer
7. Type metal salesman
8. Ink manufacturer
9. Chemist
10. Ink salesman
11. Paper manufacturer
12. Paper salesman
13. Printing supplies salesman
14. Advertising manager
15. Plant managers and owners

5. Q. Name some of the advantages of working in this field.

A. 1. A universal occupation
2. Provides skilled and semiskilled jobs
3. Offers unlimited opportunity
4. Has acceptable wage scales
5. Provides reasonably steady employment — few layoffs.

6. Q. List some of the disadvantages of working in this field.

A. 1. Nature of work requires:
a) Indoor work
b) Good eyesight
2. Sedentary occupation (in most fields)
3. Health and safety hazards:
a) Paper, ink, type metal
b) Moving machinery

7. Q. What preparation is desirable for work in this field?

A. Vocational schools which are on a high school level, or vocational courses which are definitely preapprenticeship training give desirable preparation for work in this field. It is here that a student may get all-round training in the composing room, including both machine and hand composition. In the pressroom, operation of the platen, cylinder, and automatic presses should be available together with some fundamental knowledge of bindery operations. Sometimes credit is given toward apprenticeship for this training.

Since the printing industry appeals to employees who are slightly above the average in educational background, the scholastic attainment is, therefore, two years of high school and often high school completion.

8. Q. Are there opportunities for women in this field?

A. Printing is predominantly a man's occupation, however, women are sometimes employed as Linotype and Monotype keyboard operators while a considerable number of them work in the pressroom as job press feeders and also in the bindery as operators performing various phases of bindery work.

9. Q. What personal qualifications are desirable for promotion in this field?

a) Ability to get along with others
b) Creativeness
c) Mastery of details
d) Mechanical and/or artistic ability

10. Q. What are the rates of compensation, the business opportunities available to those desirous of getting ahead?

A. The following are American Federation of Labor weekly wage rates based on a 37½-hour week in an Ohio city, and are broken down into the three major fields. Also listed are rates for allied jobs in the lithography field.

Obviously, these rates vary according to location and date of contract, however, they may be used as a basis for comparison. The following rates were in effect as of January 1, 1948:

Composing Room	Per week
Hand and machine compositors, also proofreaders (night $2.50 add.)	$81.00
Pressroom	
Job and automatic pressmen, from	$61.37 to $75.25
Cylinder pressmen	$75.25
Web and rotary pressmen (night $2.50 add.)	$75.25 to $86.50
Bindery	
Bindery men (including paper cutters)	$71.25
Bindery women	$39.97
Allied Jobs in Lithography	
Artist	$67.20 to $77.20
Engraver	$68.20
Prover	$72.20
Photographer	$62.20 to $82.20
Stripper	$60.20 to $68.20
Platemaker	$68.20
Offset pressman (rotary)	$70.20
Offset pressman (single-color)	$62.20 to $74.20
Offset pressman (two-color)	$76.20 to $82.20
Offset pressman (four-color)	$74.00 to $88.00

Night rates — 10 cents per hour above day rates for all journeymen.

Other Opportunities

Layout man; advertising manager; printing supply salesman (type metal, ink, and paper); plant manager and/or owner. Remuneration depends upon size of plant and volume of business.

DOLLHOUSE LABORATORY SPEEDS PETROLEUM RESEARCH

GULF OIL CORPORATION
Pittsburgh, Pa.

Progress toward meeting history's greatest demand for oil is being aided by the micro-laboratory — where scientists work with "doll-sized" instruments in a world of the infinitely small.

Girl operating micro-manipulator which handles tiny tools beneath microscope lens

Contrast the size of the hands with the size of the tiny tools

The petroleum micro (meaning small-scale) laboratory is successfully speeding research. Its results are achieved by working with quantities of material ten to hundreds-of-thousands of times smaller than used in ordinary research. These smaller samples can be analyzed with far greater rapidity than normal amounts.

Conservation of expensive and scarce chemical materials (some of which may have taken months to distill in minute quantities); saving of two thirds in sorely needed laboratory space; and ability to study substances so small as to otherwise defy analysis, represent other microlab advantages.

Then, too, highly explosive materials may be experimented with on such a reduced scale that serious explosion dangers are eliminated.

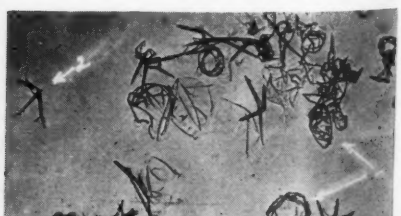
The extremely small size of the equipment used for this type of industrial research is very interesting. A tiny feather fastened to the end of a glass rod serves as a brush. Glass capillaries, or tubing which is thinner than a match stick, replace standard test tubes.

Tiny "boats" transport materials. These materials in turn are shoveled or handled by scoops, knives, and pincers scaled proportionately.

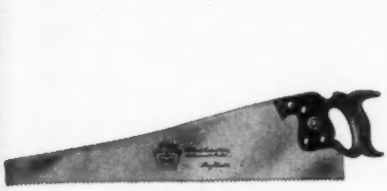
A glass encased balance, fundamental instrument of microchemistry, provides a weighing scale so sensitive that it accuratey measures weights less than one ten-millionth of an ounce.

A micromanipulator, a fabulous machine for handling instruments too small to be accurately directed by the human hand, enables the scientist to work in a drop of water under

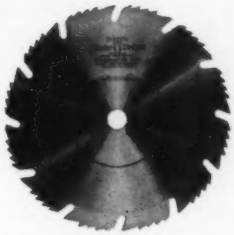
(Continued on page 26A)



"A fraction of wax" as it looks to a micro-chemist

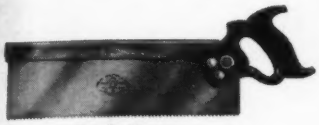


Hand Saws



DeLuxe Circular Saws

Band Saws

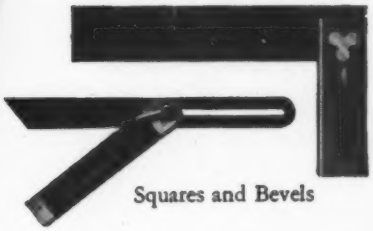


Back Saws

Hack Saw Frames and Blades

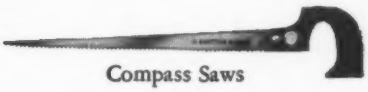
Coping Saws

DISSTON
Quality Tools for the School Workshop



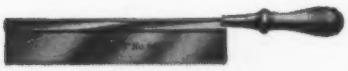
Squares and Bevels

Files and Rasps



Compass Saws

Wood Turning Tools



Dovetail Saws

TOOL QUALITY AND TOOL ECONOMY GO HAND IN HAND

More and more Industrial Arts Instructors are specifying Disston Tools for school workshop use. They find that Disston Tools cut faster, stay sharp longer and give extra years of dependable service . . . results that are due to Disston tool-making skill and the fine quality of Disston Steel.

Their use is important to students, too. They find that with Disston Tools their assignments are easier to perform, their work neater and more accurate, and their progress faster . . . all of which combine to simplify the instructor's task.

For better service and greater tool economy, specify ALL of the fine Disston Tools shown here.

Each of your students should have a copy of The Disston Saw, Tool and File Manual. Free copies may be obtained from hardware retailers, or students may write to us direct.

HELPFUL EDUCATIONAL AIDS for use in your classroom will be sent to you without charge. These include Wall Charts; Saw, Tool and File Manual; and Industrial Product Manuals for teacher reference on the use and maintenance of saws and tools. Write to us for a complete set today.

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HENRY DISSTON & SONS, INC., 938 Tacony, Philadelphia 35, Pa., U.S.A.

(Continued from page 24A)

a microscope as if he were utilizing materials in beaker and test tube. Within the drop, he can move particles too small for the human eye to distinguish by means of the manipulator's infinitesimal probes, rakes, hoes, etc.

Quantities of solutions dealt with are sometimes so small that they must be kept in transparent, humidified cells, since exposure to air would cause instant evaporation of the entire sample.

These instruments enable the detection of quantities too small for human perception. By analyzing the scrapings from a man's hand, the laboratory can determine whether the hand has recently touched a brass doorknob. By examination of a silver coin, micro-scientists know whether it has been rubbed against a nickel in a change pocket.

Microlab "spot tests," to determine the nature of a material from a crystal or drop of its solution, allow immediate identification of many complex mixtures, without resorting to the usual methods of separation and isolation.

A portable "spot test" laboratory has been developed, which can be carried in a suitcase size container. By its means, analyses can be made anywhere in the field, saving weeks or months in the gathering and back and forth transport of materials.

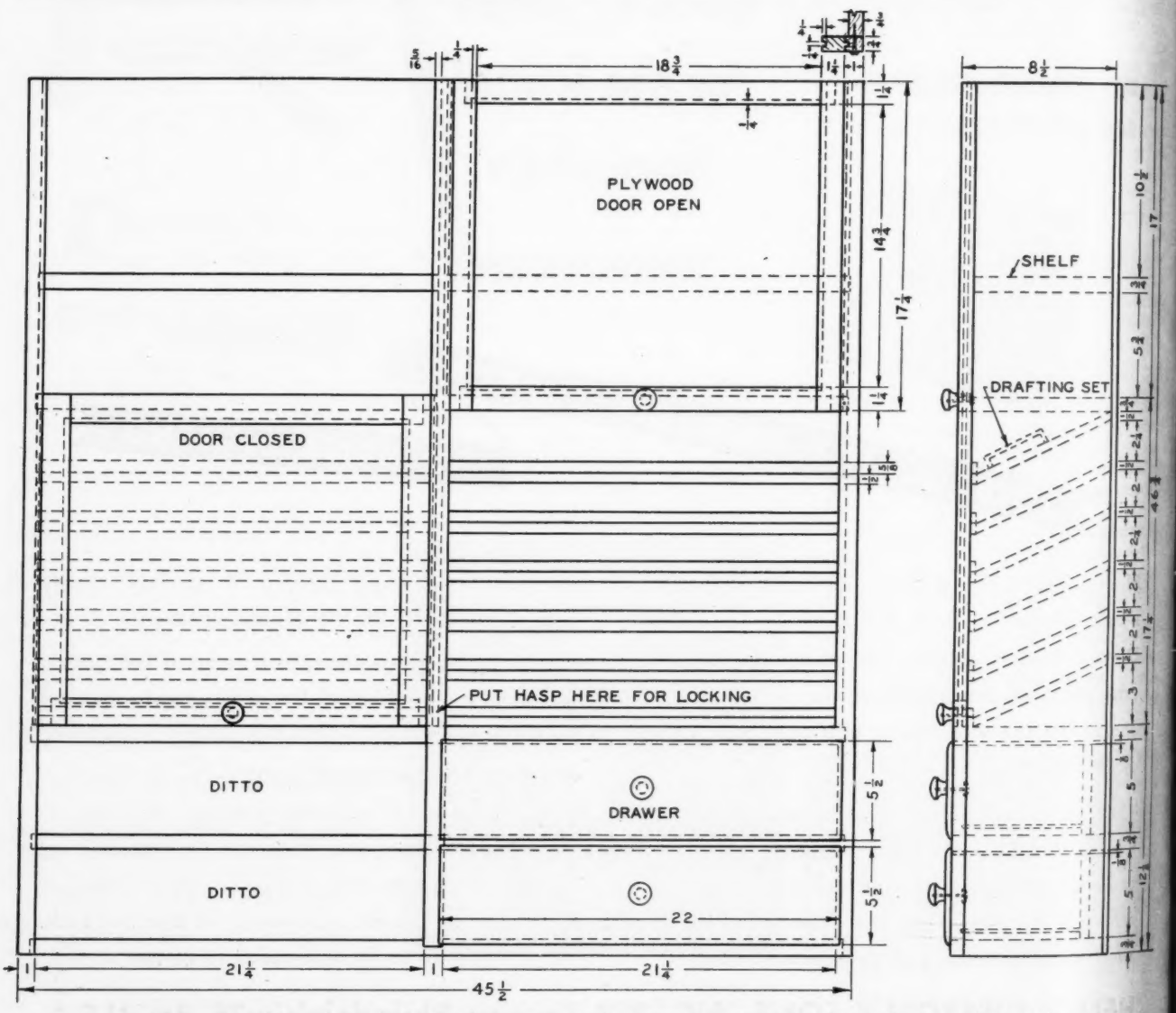
Determination of carbon, hydrogen, and oxygen, more used in organic analysis than any other test, has been tripled in speed by miniature combustion units which the microlab has helped perfect. These automatic, electrical furnaces move at varying rates along combustion tubes and may be set for desired cycles, leaving research workers free for other tasks.

Similar techniques have been developed for automatic nitrogen, sulfur, and hologen determinations.

Microscopic work is being successfully applied to regulating the size of catalysts — key material in modern refining — through use of microscope grid screens. So-called dark field microscopy, where objects are studied by refracted light, has notably successful results in application of the material (silicones) used in nonfoaming oil.

Analysis by polarograph (an instrument using the principles of electrolysis) is applied to dilute solutions containing tiny percentages of materials for "trace" analysis. This eliminates or shortens lengthy separation of elements. Actual analyses can be run in 10 minutes in place of perhaps six hours required in orthodox procedure.

Scores of such microlab developments are bringing closer tomorrow's solutions to the multitudinous problems which arise in producing more and better petroleum products for an oil-hungry world.



Drafting set cabinet for school drafting room. Louis Barocci, instructor, High School, Cudahy, Wis.

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for faster, more accurate blows . . Get a PLUMB

The second-growth Hickory Handle on every Plumb Hammer is shaped for a comfort grip and tested for strength. The black, one-piece head is double tempered from special-analysis steel. When you use a Plumb Hammer, you'll be amazed at the speed, power and precision of your strokes. You'll find that the ease with which it handles cuts down muscular fatigue. Best of all, you can count on a Plumb to last a lifetime. Fayette R. Plumb, Inc., Phila. 37, Penna.

The red handle with the black head —exclusively Plumb

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Technical Drawing Work Sheets
by COLE and HOBART
A *new* text, consisting of 64 work sheets plus a 64 page manual of instructions.

Drawing Problems for Technical Students
by COLE and HOBART
Designed primarily for use with *Engineering Drawing* by Hobart, with notes referring to that text.

Engineering Drawing
by D. E. HOBART
A compact and straightforward text to introduce the student to progressively difficult drafting procedures and mathematical calculations.

An Introduction to Drafting
by STANLEY J. PAWELEK
To lead the beginner, by means of freehand sketching, to an understanding of the basic principles of drafting.

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by KEPLER, NICHOLSON, SLOAT, and TUCKER
A new publication — a complete analysis in outline form of the content of mechanical and engineering drawing.

Descriptive Geometry
by MILLAR and SHIELS
The fundamentals of descriptive geometry developed to follow an elementary course in mechanical drawing.

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Personal News

STUDEBAKER RESIGNS AS COMMISSIONER OF U. S. EDUCATION

Dr. John W. Studebaker, 61, resigned as U. S. commissioner of education on June 29. His resignation effective July 15, was accepted by President Truman.

Studebaker announced later that he would become vice-president and chairman of the editorial board of *Scholastic Magazines*.

Earlier in the week the office of education's second in command, Deputy Commissioner E. B. Norton, resigned effective June 30. The resignations left Associate Commissioner Edwin H. Miner in command.

DR. JOHN R. LUDINGTON APPOINTED TO WASHINGTON POST

JOHN R. LUDINGTON, professor of industrial-arts education, and state supervisor of industrial-arts education in the state of North Carolina,

Dr. John R. Ludington

has been appointed specialist for industrial arts in the Office of Education. Dr. Ludington will begin his duties in the U. S. Office of Education as soon as suitable arrangements can be made for his successor in North Carolina.

♦ RALL I. GRIGSBY has been named acting commissioner of education. Mr. Grigsby will also continue to serve as director of the division of auxiliary services, office of education. He has been a member of the Office of Education staff since 1939.

♦ WILLIAM F. PATTERSON, director of the Department of Labor's Bureau of Apprenticeship, left for Europe during the month of May, to survey the possibilities of assisting France, Italy, and Greece to strengthen their skilled labor forces. Mr. Patterson's work will be in connection with the Labor Department's participation in the programs authorized by the U. S. Information and Educational Exchange Act of 1948.

♦ JOHN M. BROPHY, who has had much teaching experience in the field of vocational education in Wisconsin, Florida, and elsewhere, and has served as research assistant in the field of industrial education at Cornell University, has received his doctor's degree from that University, and has also been appointed a member of the regular staff of that institution with the title of assistant professor in the school of industrial and labor relations.

♦ R. RANDOLPH KARCH has been appointed director of education of Graphic Arts Industry, Inc. He assumed this position on July 1.

Mr. Karch was born in Ohio in 1902 and served an apprenticeship as a compositor in Cincinnati. Has worked as a journeyman in both commercial and newspaper establishments, and is thoroughly experienced in all branches of hand composition and machine composition, cylinder and platen presswork, bindery, platemaking, and offset operations. His background of experience includes instructor in printing in high schools of Steubenville, Ohio, Cincinnati, Ohio, and Pittsburgh, Pa.; Technical Supervisor of the Department of Publishing and Printing, Rochester Institute of Technology, Rochester, N. Y.; and principal of the Graphic Arts High School, Cincinnati, Ohio.

During the recent war he served with the rank of lieutenant commander in the navy as officer-in-charge of publications, in the writing and editing of instruction manuals used by the navy in connection with special training activities. He also served as a member of the admiral's staff at Pensacola, Fla., as printing adviser to the Naval Air Training Command, later serving as publications control officer for the Fourth Naval District with headquarters in Philadelphia.

After his retirement from the navy, he held the position of director of typography, advertising manager, and manager of the printing department of Intertype Corp., Brooklyn, N. Y., having for the past several years been in charge of those activities for this nationally known firm.

He is active as a member of the International Association of Printing House Craftsmen, having served as a member of the board of governors of the Cincinnati Club, as educational chairman of the Rochester Club, and president of the Pittsburgh Club; also having served as chairman of the research commission of that international association; director of National Association for Printing Education; and as secretary of the National Graphic Arts Educational Association, acting as its convention chairman in 1940.

♦ W. BEN. HUNT, of Hales Corners, Wis., well-known author of books and articles on whittling, log cabin construction, flat bows, Indianlore, camp handicrafts, rustic construction, lettering, and various boy scout activities, received the silver antelope award from C. J. Otjen, the scout commissioner of Milwaukee County, Wis., on May 6, 1948. The award was given him because of his outstanding service to the boy scouts and their leaders.

♦ DR. SHIEN-SIU SHU, noted Chinese scientist, has been appointed associate professor of mathematics and research associate in mechanics at Illinois Institute of Technology, Chicago, Ill.

At 34, Dr. Shu has established an outstanding reputation in the fields of applied mathematics and fluid mechanics. From 1939 to 1943, he was instructor and lecturer at National Tsing Hua University in Peiping, China. He came to the United States in 1944 as a research associate at Brown University, from which he obtained his Ph.D. in 1947. He spent last year at the Institute for Advanced Study in Princeton, and this summer is carrying on research at Massachusetts Institute of Technology.

♦ Friends of the members of the staff in Industrial Arts Education at Eastern State College, Charleston, Ill., may be interested in the following news:

DR. RUSSELL H. LANDIS served during the war in the "Division of Vocational Training for War Production Workers" of the U. S. Office of Education. He returned to his post in September, 1946, where he teaches printing and mechanical drawing. He earned his doctorate from Pennsylvania State College and holds the rank of professor.

During the war DR. WALTER A. KLEHM remained at his post conducting a program in "Vocational Training for War Production Workers." His fields of teaching are in history, philosophy, and methods in industrial arts, and he assists in mechanical and architectural drawing. He is head of that department.

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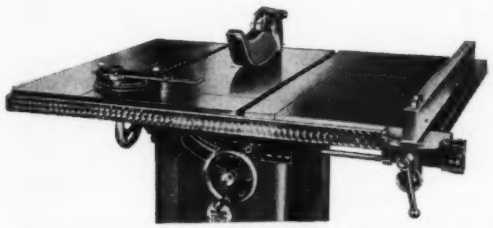
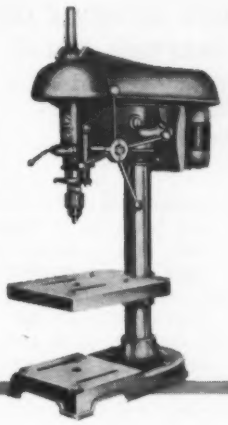


10" Tilting Arbor Saw, Model TA-1180B. Cuts to depth of 3", angle cuts to 45°, accurate self-indexing miter gage. All-over safety features. Price: less motor, switch, extension tables, guard and splitter, $150.00



15" Drill Press, Bench Model D-950. Chuck to table, maximum 18½". 4 ball bearings; 4¼" spindle travel, adjustable spring return. Depth gage of micrometer accuracy. Speeds 600 to 5000 r.p.m. Capacity ½". Price: less motor and belt guard, $69.50

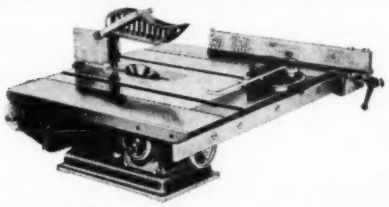
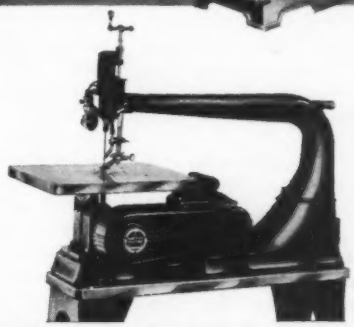


Table Saw, Model CB-970. Sufficiently light for take-about utility. Hand crank control of blade tilt. Capacities: 8" saw, 2½" cut, 9" saw, 3" cut. Accommodates 6" dado. Motors recommended: 8" blade, ½ h.p.. 9" blade, 1 h.p.—3450 r.p.m. motors. Price: less miter gage, motor and extension tables, $59.50



Jig Saw, Model J-915. Large table; tilts to 45°, quadrant indicator. Throat capacity 24"; arm removable for large work. Four speeds: 600, 900, 1250 and 1740 r.p.m. Price: less motor, belt guard, bench lamp, switch and cord, $59.50

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REPRODUCTION METHODS USED IN THE DRAFTING ROOM

F. N. NEWTON, JR.
Supervisor of Industrial Education
Sharon City Schools
Sharon, Pa.

After the design engineer, or draftsman, has placed his ideas and plans on a sheet of tracing paper or cloth, they cannot be used efficiently unless copies of the drawing can be obtained quickly and cheaply. Obviously, it would not be good practice to take the original tracing into the shop where it would very quickly be mutilated and rendered unfit for use because of grease, oil, and grime. Every large engineering department maintains a reproduction section where copies of various kinds are made from the original tracing. The original is then filed for future reference, in steel files that are fire, water, and dust resistant.

There are many types of reproductions and many methods for making them. This paper deals only with the most important methods, and will describe the types of reproductions and the various machines used to produce them. It is not intended to give a complete and detailed description of every operation necessary to procure copies of a drawing but rather to convey a general idea of the different processes used.

Blueprints. The method most commonly used to produce duplicate copies of original plans for the use of the construction engineer in the field or the workman in the shop, is that of blueprinting. A blueprint is produced by first preparing the sensitized paper, and various solutions are used in the sensitizing process. One method is to coat the paper with a solution of oxalic acid and iron and then treat it with a solution of potassium ferrocyanide. The original drawing, made with India ink or an opaque pencil on a translucent material which will allow light to pass through it, is placed over the paper and exposed to intense light. After exposure the paper is washed in pure water and white lines are found where the black lines appeared on the original drawing. The completed print is, therefore, composed of white lines on a solid background of blue. It might be of interest to know that the art of blueprinting was first credited to Sir John Frederick Herschel (1792–1871), a noted English astronomer, who was also distinguished as a chemist and attained some important results in photography.

Blueprinting originally was a very crude process since it was necessary to expose the paper to the sunlight in, what was known, as a sunframe. This was a very uncertain procedure because the absence of the sun usually prohibited the making of prints. A modern blueprint machine will produce blueprints of a uniform color at a speed of from 2 to 25 feet per minute, depending on the density of the original material. Larger industrial concerns use a continuous blueprint machine, consisting of a combination of printing, washing, and drying units. The blueprint paper is sold in rolls 200 yd. long, and is fed through the machine in a continuous strip. The tracing is placed on the paper and is drawn over a glass segment by a tight canvas belt which provides close contact between the tracing and the paper. As the combination passes over the glass surface it is exposed to powerful arc lights. After exposure, the original tracing is returned to the operator and the paper passes through several baths of water where the color is developed. It continues through electrically heated ovens and drums where it is thoroughly dried and it is delivered at the rear of the machine, ready for the trimmer to cut and separate the individual prints.

Black and White Prints. A blueprint is a negative copy of the original; that is, where the original tracing has black lines, the blueprinted copy has white lines. Some years ago, a process was developed, known as the "black and white" process, which produces a direct print rather than a negative one. That is, the lines of the original are black and the lines on the copy are also black. The use of this type of print is constantly growing since it is more natural to read a positive print than a negative. Also, it is much easier to make changes and notations on a white background than on a background of dark blue. This type of print is exposed to light, similar to a blueprint and on the same type of machine. The developing, however, is entirely different. It is developed instantly by contact with the developing agency and is slightly moistened on the back with pure water so that it will dry evenly. Because the black and white print is not soaked in water like a blueprint, it does not expand or contract very much and the finished print is much nearer to scale than a blueprint.

Photocopy prints or negative photostats. Very often it is desired to procure an enlarged or reduced copy of an original drawing, or perhaps the original is too opaque to get a blueprint copy or a black and white print. To get a print of this type a photocopy machine is used. There are several machines of this type on the market but probably the most common is the photostat. A photostat machine will produce an exact copy of anything which is written, typewritten, printed, or drawn. This machine is really a large camera and is constructed to photograph directly upon sensitized paper, which, through a process of development entirely within the lightproofed cabinet, becomes the finished print. The subject to be copied is placed on a copy board below the camera and in the direct line with the lens. The copy board can be moved up or down and the bellows of the camera can be moved in and out so that copies of the desired size can be quickly photographed. Scales are provided on the copy board and also on the bellows mechanism. By co-ordinating these scales focusing becomes almost automatic and prints perfectly focused are obtained with little difficulty. A prism is placed in front of the lens to correct the reversing action of the lens so that the finished print is reproduced exactly like the original rather than backwards, like the negative secured from a camera with an ordinary lens. The sensitized paper comes in rolls 350 ft. long and is fed through the exposure chamber and into the developing tray in a continuous strip. After the paper is exposed and rolled into the developing tray, it is cut from the roll. It is permitted to remain in the developer for a predetermined length of time and is then placed in the fixing solution. Later, it is washed in clear water and dried in an electrically heated drum drier. These operations are all automatic and once the proper time values for each operation are determined, perfect prints are secured with very little difficulty. The finished print is a negative and if a positive print is desired, it is necessary to repeat the printing and developing operations using the negative as the original. To produce photostats, illumination of uniform intensity is necessary. To secure this even illumination, mercury arc tubes are placed on each side of the copy board and these tubes, with suitable reflectors, are adjustable up or down with the copy board.

Photo Reproductions or Photo Litho. Sometimes a draftsman finds he is to make up a new drawing which is almost an exact duplicate of an existing drawing. In the past it was necessary for a tracer to retrace laboriously on tracing cloth that portion of the old drawing which was to be used on the new drawing. Then the draftsman would complete it by adding the new features and parts. This process required a lot of time and it was necessary for the draftsman to check the tracer's work very carefully for errors or omissions. The photo-litho method has been developed whereby an exact reproduction of the original drawing can be made photographically direct on a piece of waterproofed tracing cloth. No checking is necessary because the copy tracing contains all of the information which is on the original. To secure a copy of this kind it is first necessary that a Van Dyke or negative print be made from the original tracing. A Van Dyke is made in the same manner used for blueprint except that the finished print is composed of pure white lines on a dense, light-repellent brown background. The Van Dyke is air-dried, to avoid stretching of the paper, so that the lines are not distorted or thrown out of scale. When the Van Dyke is thoroughly dry, it is placed on a sheet of sensitized waterproof tracing cloth, and exposed to intense arc light illumination. This exposure is made either in a regular printing machine or a flat-bed vacuum frame. Perfect contact must be maintained between the Van Dyke and the cloth in order to avoid broadening or fuzziness of the lines. After the cloth has been exposed, the excess chemicals are washed from it by spraying it with clear water. It is then immersed in the developing solution. It remains in the developer until the image is clear and distinct when it is again sprayed with clear water and all spots and stains removed by swabbing with soft cotton. While on the cleaning board and still wet it is possible to remove all unwanted parts or

(Continued on page 34A)

We're now getting mail from overseas!

4 March, 1948

I am a Technical Teacher in a Secondary School, also a subscriber to Industrial Arts and Vocational Education. I was tremendously interested in your advertisement, "No. 1 Attention Getter"...so much so that I am taking the liberty of asking if I may have back copies for 1947.

It is very difficult at the moment to obtain teaching aids such as yours, in this country. I would be very grateful for copies.

Yours sincerely,
John Jolly
John Jolly
202 Strathmartine Road
Dundee
Angus, Scotland

6 May, 1948

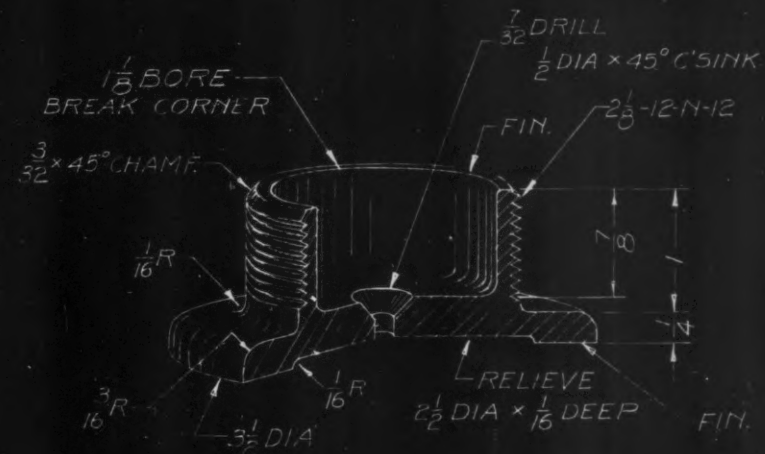
I want to thank you for mailing a copy of your Eldoradostat. The amount of additional work done by teachers in Scotland is considerable, as the pupils may have milk, dinner and medical treatment as well as measurements for clothing coupons. All this is done in school time, which considerably curtails the teacher's time for preparing lessons.

Your Eldoradostat is therefore of great help, and if it were possible to buy these through a publisher, I would willingly do so.

Many thanks.

Yours sincerely,
John Jolly

More and more new Eldorado teaching helps!



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3. Masonry Simplified — Tools, Materials, Practice. Vol. I..... 4.50
4. Masonry Simplified — Practical Construction. Vol. II..... 5.00
5. Building Trades Blueprint Reading Part I..... 2.25 Part II..... 2.25
6. Simplified Architectural Drawing..... 5.00
7. Steel Square..... 2.25
8. How to Design and Install Plumbing.... 3.50

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10. Direct-Current Motors and Generators.... 3.00
11. Electric Generators..... 2.75
12. Transformers 2.75
13. Interior Electric Wiring and Estimating.. 2.75
14. How to Read Electrical Blueprints..... 3.25

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15. Machine Shop Work.....$3.75
16. Machine Trades Blueprint Reading..... 2.25
17. Metallurgy 5.00
18. Tool Making..... 4.00
19. Sheet Metal Work..... 3.00
20. Pattern Making..... 2.25

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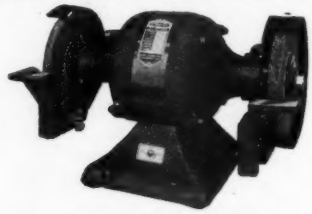
Shop Equipment News

NEW PRODUCTS — PUBLICATIONS

NO. 226 BENCH GRINDER

Stanley Electric Tools, New Britain, Conn., introduces its new No. 266 Bench Grinder. Powered by a ¼-hp., ball bearing, constant speed induction motor, this grinder is ideal for garages or factories, for light grinding, sharpening tools, buffing, polishing, and wirebrush work. Its many



New Stanley No. 266 bench grinder

features include full ball bearing action, bearings enclosed against dirt and grit, safety type wide wheel guards, adjustable tool rests, and a toggle type switch enclosed in a molded case located in the base of the grinder. Guards are adjustable to permit grinding at any point on the circumference of the wheel. The speed of the grinder at 60 cycles is 3450 r.p.m. It is furnished with two 6 by 2-in.wheels, one coarse, one fine.

For brief reference use IAVE—0901.

NEW 7-IN. LIGHT FLOOR EDGER

A high speed 1¼-hp. floor sanding edger that weighs only 25 lb., has been introduced by the Porter-Cable Machine Co., Syracuse 8, N. Y. The new model BE-7 is designed for a wide range of use, and is an addition to the previous line of edgers produced by this firm.

New 7-in. light floor edger

The new edger, guided by two convenient handles will glide easily over the work on two ball bearings. Its own weight supplies the necessary pressure against the floor. Universal a.c. or d.c. 115-volt salient-pole motor drives through helical gears thus delivering tremendous power and speed to the revolving disk. The disk revolves at 3200 r.p.m. A fast sanding operation results, with the finished work blending in and matching with the work of a drum sander.

An electric light, protected by a metal shield, in front of the machine illumines the work area in dimly lighted rooms, corners, and closets. A feature of the BE-7 edger is a hardened steel, chrome guard, preventing the disk from damaging upright objects, yet permitting the abrasive disk to sand flush with baseboards, stair risers, or quarter rounds without touching them. Dust is sucked into the intake surrounding the disk, through a dust channel inside the frame, and blown into a zipper bag. The bag is easily removed and quickly cleaned.

Model BE-7 accommodates a 7-in. paper-backed abrasive disk with a ⅞-in. hole. The disk can be changed in one minute; a cutter is supplied as standard equipment so that disks may be cut out of abrasive paper if so desired.

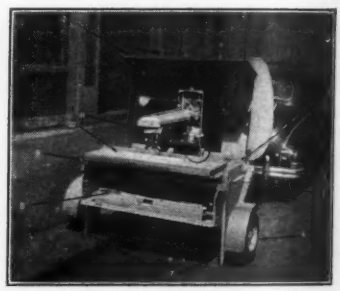
The frame of the edger is cast aluminum alloy and has a mirror finish. For further information write: Porter-Cable Machine Co., 1714 North Salina Street, Syracuse 8, N. Y.

For brief reference use IAVE—0902.

PORTABLE RADIAL SAW CART

For portable sawing facilities, J. D. Wallace & Co., announce the development of a trailer to carry their No. 1 radial saw from job to job.

The machine itself is an all-purpose saw that does crosscutting, mitering, compound-angle cuts, ripping, dadoing, rabbeting, shaping, routing, and many other jobs. The trailer in which it is mounted is designated as the "radial saw cart," and is fitted with a new-style spring suspension that rides very smoothly.



Portable radial saw cart

A removable caster wheel at the trailer hitch permits the saw cart to be detached from the automobile and rolled around the job site. Made with a sheet aluminum top that hinges back for operation, the body of the trailer includes a panel and mounting studs to hold saw blades, dado heads, shaping heads, and other accessories; a reel for holding an extension cord; and a storage space under the machine for table extensions, jigs, and fixtures. Quick-acting jacks built into the sides are used to bring the table of the saw up to working height and to level it off despite irregularities of ground level. Table extensions bolt to sides of machine for holding long stock while sawing.

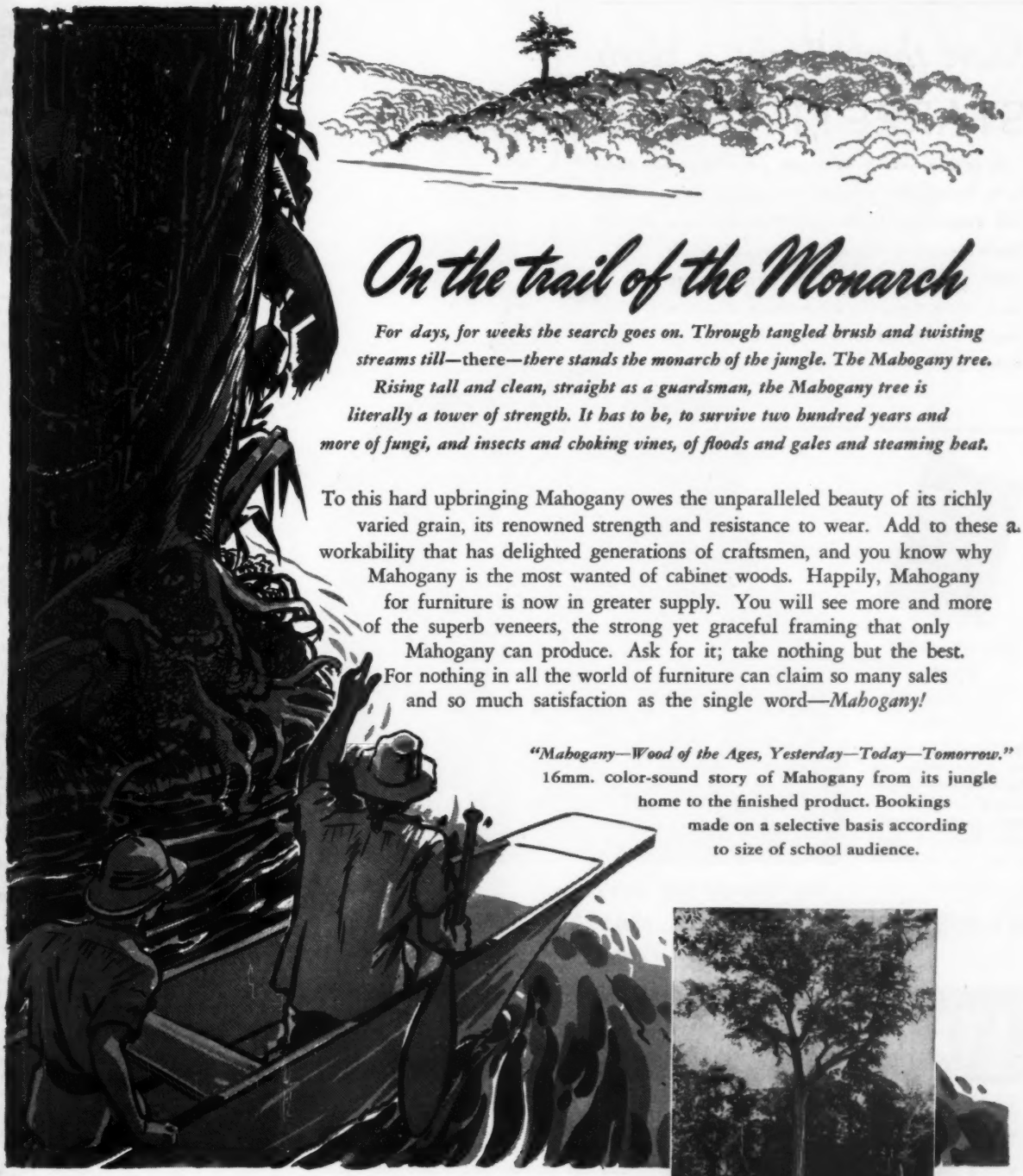
For free bulletin write to J. D. Wallace & Co., 140 S. California Ave., Chicago 12, Ill.

For brief reference use IAVE—0903.

A NEW COLLET CHUCK

A collet chuck that is safe and accurate for fine, close work has been put on the market by the Delta Manufacturing Division of the Rockwell Manufacturing Company, 600 East Vienna Ave., Milwaukee 1, Wis., makers of homecraft and machine power tools. It can be used on any lathe with a 1-in. diameter spindle, having

(Continued on page 39A)



On the trail of the Monarch

For days, for weeks the search goes on. Through tangled brush and twisting streams till—*there*—there stands the monarch of the jungle. The Mahogany tree. Rising tall and clean, straight as a guardsman, the Mahogany tree is literally a tower of strength. It has to be, to survive two hundred years and more of fungi, and insects and choking vines, of floods and gales and steaming heat.

To this hard upbringing Mahogany owes the unparalleled beauty of its richly varied grain, its renowned strength and resistance to wear. Add to these a workability that has delighted generations of craftsmen, and you know why Mahogany is the most wanted of cabinet woods. Happily, Mahogany for furniture is now in greater supply. You will see more and more of the superb veneers, the strong yet graceful framing that only Mahogany can produce. Ask for it; take nothing but the best. For nothing in all the world of furniture can claim so many sales and so much satisfaction as the single word—*Mahogany!*

"Mahogany—Wood of the Ages, Yesterday—Today—Tomorrow." 16mm. color-sound story of Mahogany from its jungle home to the finished product. Bookings made on a selective basis according to size of school audience.

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REPRODUCTION METHODS

(Continued from page 30A)

lines with a soft eraser or cotton. When dry, it is delivered to the draftsman who, to complete the drawing, merely has to draw in the new parts or sections with India ink. It is then possible to make blueprints, black and white prints, or any other type of copies from it similar to the ones made from an original hand-drawn tracing.

Other Reproduction Methods. The processes just described are normally used for obtaining copies from drawings made on a translucent material. Often it is necessary to obtain copies from specifications and other written or typewritten material. Various methods are used to secure these copies and the particular method used depends upon the number of copies desired and the purpose for which the copies are to be used. Some of these methods are multigraph, multilith, mimeograph, photo offset, hectograph, and ditto. Each of these processes has its own field but no lengthy description of them is necessary in this paper.

Conclusion. Reproductions of any kind cost money, and the draftsman can hold this cost to a minimum by carefully choosing the size of sheet on which he makes his drawing. As an example, most standard drawing sizes are 9 by 12, 12 by 18, 18 by 24, and 24 by 36. If the draftsman used a 24 by 36 sheet when an 18 by 24 sheet would have been large enough, each blueprint made from the drawing will contain 6 sq. ft. of paper instead of 3 sq. ft. The actual approximate cost of producing a blueprint, exclusive of the labor involved, is 2 cents per sq. ft. so each print made would represent a cost of 12 cents instead of 6 cents, a loss of 6 cents per print. The average industrial concern will produce 10 prints from each tracing so this represents a loss of 60 cents per tracing. In a large concern this would represent a considerable amount over the period of a year. These prices are based on prewar prices and would likely run even higher now.

PERSONAL NEWS

(Continued from page 28A)

HARRY GUNDERSON of Bloomington, Ind., has joined our faculty. He has taught for ten years in Richmond, Ind., and has had five years of industrial experience. He is at present writing his doctoral dissertation at the University of Indiana.

Upon EWELL FOWLER'S discharge from the U. S. Army in August 1945 he returned to Eastern's Campus and became associate professor in industrial arts. Formerly he was critic teacher in industrial arts in the college high school. During the year of 1946–47 he was on sabbatical leave doing advance graduate work at the University of Missouri. During the summer of 1948 he returned to the university and completed his residence work for the doctorate.

CHARLES A. ELLIOTT came to the industrial arts faculty at Eastern in the fall of 1946 after serving as an instructor in the Second Air Force, Pueblo, Colo. He holds the master's degree from the University of Missouri and has plans to start work at an early date on his doctorate. He is instructing in the fields of general metal and electricity.

OTHO QUICK is serving on the staff in the capacity of critic teacher in industrial arts. He holds the master's degree from the University of Minnesota. He attended the University of Minnesota during the summer of 1948 doing advance graduate work.

ROBERT THRALL is helping on the instructional staff at Eastern on a [illegible]-time basis. The remainder of his time is devoted to aiding his father in his local business. During the war he served as instructor at Chanute Field, Ill. He holds the master's degree from the University of Illinois and is instructing in the field of crafts.

♦ FRED R. TRAVIS, admissions counselor at Illinois Institute of Technology, has been named director of admissions, effective June 1, 1948, as announced recently by John F. White, dean of students.

Travis joined the admissions department staff last summer after obtaining bachelor's degrees from Illinois Tech both in mechanical and industrial engineering.

He succeeds Warren S. Sivertsen, who recently resigned to accept a position with the YMCA in New York.

Travis is a native of Scranton, Pa., where he was graduated from Central high school in 1941. He is a member of Tau Beta Pi, Pi Tau Sigma, and Pi Nu Epsilon, Association of College Admission Counselors, and board of directors of the Illinois Tech Alumni Association.

He was employed for two years by the Bendix Aviation Corporation in Philadelphia and served almost three years in the navy during World War II.

♦ W. KARL LOUGHBOROUGH retired from the staff of the U. S. Forest Products Laboratory, Madison, Wis., on June 30. On the Laboratory staff since 1918, Mr. Loughborough has spent 38 years in the Forest Service of the U. S. Department of Agriculture.

(Continued on next page)

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Mr. Loughborough's research in kiln drying led to his selection during World War II as the man to direct a nationwide program of dry-kiln inspection and certification for the army air forces. This work was necessary to insure the production of high-quality lumber needed for the many thousands of wood aircraft and gliders built during the war. As part of that program, he directed the training of hundreds of operators in exacting techniques of kiln drying.

Among his research achievements has been the development of chemical seasoning of wood. While working in this field, he discovered that wood can be plasticized by treatment with certain chemicals. United States patents obtained on this treating process have been dedicated by him to the free use of the public.

His most recent patent is for a "process for resinifying ligno-cellulosic material with urea-formaldehyde." This process, an outgrowth of his work in chemical treatment of wood, produces a molding powder from chemically treated wood for plastics.

♦ CARL D. PIERSON, JR., 29, of 1338 North Laramie Ave., Chicago, has been appointed instructor in electrical engineering at Illinois Institute of Technology, it was announced recently by Dr. E. R. Whitehead, director of the department.

Pierson was graduated from Armour Tech, predecessor of Illinois Tech., in 1940. He obtained his master's degree from Illinois Tech in 1947.

From 1941 to 1948 he was senior engineer and division engineer of the Belmont Radio Corporation in research and development. For two years during the war he was a radar officer with the U. S. Navy.

♦ The following men received the master's degree in education with a major in industrial education from Wayne University, Detroit, Mich., in June, 1948: JOHN M. AMISS, KENNETH CARAKOSTAS, WILLIAM V. HARPER, JOE KONYA, JR., CLAYTON C. LUTHER, ROBERT E. MARTIN, ADRIAN POLLOCK, RICHARD M. RAMSDELL, WILLIAM T. SARGENT, and HARTLEY H. SCHAAL.

♦ LEE RALSTON, director of trade and industrial education, Los Angeles County Schools, left early in April on a 90-day assignment to Venezuela to help establish a training program.

♦ HORACE SCHORLING, assistant professor of industrial arts, Fresno State College, Fresno, Calif., will leave on September 1 for a 6-month assignment in Korea, where he will participate in a survey preliminary to establishing an educational training program.

♦ WILLIAM B. LOGAN, Greensboro, N. C., has been appointed instructor and teacher trainer in distributive occupations on the staff of the Department of Education at Ohio State University.

♦ SCOTT EMERSON WOOD, assistant professor of research and physical chemistry at Yale University, has been appointed associate professor of chemistry at Illinois Institute of Technology, Chicago, Ill., effective September 1.

Dr. Wood obtained his bachelor's and master's degrees from the University of Denver in 1930 and 1931. His Ph.D. was awarded at the University of California in Berkeley in 1935.

♦ DOUGLAS E. RYAN, of the University of New Brunswick, Canada, has been appointed instructor in chemistry at Illinois Institute of Technology, Chicago, Ill. The appointment is effective September 1.

♦ ROBERT WORTH FRANK, JR., has been appointed assistant professor of English at Illinois Institute of Technology, Chicago, Ill., effective September 1.

He received his bachelor's degree from Wabash College in 1934, his master's from Columbia University in 1939, and his doctor's from Yale University in 1948.

♦ LEANDER W. MATSCH has been appointed professor of electrical engineering at Illinois Institute of Technology, Chicago, Ill., effective September 1.

Since 1945, Mr. Matsch has been a supervisor in electrical engineering research at Illinois Tech's Armour Research Foundation. For 18 years prior to 1945 he was an engineer with Commonwealth Edison Company.

He was a part-time instructor from 1926 to 1940 at Lewis Institute, predecessor of Illinois Tech, and from 1944 through last year taught part time at Illinois Tech.

♦ BENJAMIN A. FISHER, professor of electrical engineering at the University of Denver, has been appointed associate professor at Illinois Institute of Technology, Chicago, Ill., effective September 1.

Before joining the Denver staff in 1946, Mr. Fisher served five years in the navy as commander at the U. S. Naval Academy, where he taught electrical engineering. He was on military leave from Oklahoma A. & M. College, whose faculty he joined in 1927 as an assistant professor. He was advanced to associate professor in 1932 and full professor in 1937.

♦ J. HENRY HOLLOWAY, principal of the New York School of Printing, is retiring after fifty years of activity in the field of education.

Mr. Holloway served as first president of the National Graphic Arts Association, and also was the founder of the International Junior Benjamin Franklin Society.

He was guest of honor at the convention of the National Graphic Arts Association held at New York City, June 21 to 23 of this year.

♦ VERNE THOMAS has been appointed instructor of auto mechanics at the Kansas State Teachers College, Pittsburg, Kans.

♦ CLIFFORD K. LUSH, formerly director of vocational education and industrial arts, Minneapolis, Minn., has resigned to enter business in California. His address is 667 So. Carondelet, Los Angeles, Calif.

A farewell banquet was tendered to Mr. Lush

(Continued on next page)

SHELDON

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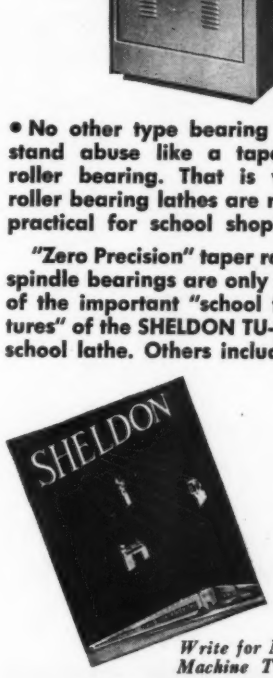
"Zero Precision" taper roller spindle bearings are only one of the important "school features" of the SHELDON TU-S56 school lathe. Others include:



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Capacity	11¼" Swing, 1" Collet Capacity, 56" Bed.
Practicality	Standard big lathe design, controls and features.
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Answer books for each trade are available.

The Connecticut State Department of Education workbooks, through organization of problem material from simple to complex, allow each learner to progress according to his own capacity. These books, now wire-o-bound in durable paper covers to "lie flat," are available for examination.

Quantity orders are being accepted for Fall Courses and Immediate Shipments can be made.

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(Continued from previous page)

by the teachers of industrial arts and vocational education of Minneapolis, on April 28, 1948.

The many friends that Mr. Lush has made in the educational field wish him success in his new undertaking.

♦ ARMIN F. GIMBEL has been appointed as instructor of metalwork in the industrial-education department of the Southwest Missouri State College in Springfield, Mo.

♦ J. K. PHILLIPS of Colby, Kans., has been appointed to a position on the Kansas state board of education. This board also serves as the state board of vocational education.

♦ RALPH C. M. FLYNT, formerly assistant director of the division of central services, has been appointed executive assistant to the commissioner of education, Federal Security Agency, and director of the division of central services.

♦ LANE C. ASH, of Philadelphia, Pa., was appointed assistant director of the division of central services to fill the vacancy created by Mr. Flynt's promotion.

♦ FRANCIS NEWTON HAYES has been named instructor in chemistry at Illinois Institute of Technology, Chicago, Ill. The appointment is effective September 1.

♦ EUGENE LIEBER has been named assistant professor of chemistry at Illinois Institute of Technology, Chicago, Ill., effective September 1.

♦ RICHARD B. BERNSTEIN of Union, N. J., has been appointed assistant professor of chemistry at Illinois Institute of Technology, Chicago, Ill., effectice September 1.

♦ DR. WILLIAM H. CREW, assistant dean of students at Rensselaer Polytechnic Institute, has been selected by the U. S. Air Force to serve as dean of the College of Engineering Sciences at the Air Force Institute of Technology at Wright Field, Dayton, Ohio.

As dean of the College of Engineering Sciences Dr. Crew will develop and direct the departments of mathematics, physics, mechanics, aeronautical engineering, mechanical engineering, electrical engineering, and such other departments as may be established in connection with the expansion of air force facilities.

♦ WILLIAM G. ISESON has been named professor of industrial engineering at Illinois Institute of Technology, Chicago, Ill., effective September 1.

♦ RAY A. SCHWALM has just received the M.S. degree in industrial education, at Oregon State College.

Mr. Schwalm has been granted a teaching fellowship for the year 1948–49 and will teach courses in sheet-metal and art-metal work while working on his doctorate.

♦ HARRY A. GOLDSTEIN, Tucson, Ariz., received the M.A. degree from the University of Arizona, Tucson, Ariz., with two majors in industrial arts and education, and a minor in social science.

♦ MERVIN E. SWANGO, who taught in the Pittsburgh schools since 1920, passed away on April 22, 1948.

♦ LUIS PANIZA, instructor of auto mechanics at the new vocational school in Divisa, Panama, made a tour of this country to see how we conducted our automotive classes.

♦ LEON L. JONES, 65, has taught industrial-arts work at a high school in Seattle, Wash., for 44 years without having been tardy or absent a single time.

♦ DR. R. WAYNE ADAMS, formerly at North Texas State College, Denton, Tex., has joined the staff of the industrial-arts department of the Colorado State College of Education, Greeley, Colo.

♦ MARK NICHOLS, state director of vocational agriculture for Utah, was granted a ten-month leave from his duties to serve as field representative for the American Institute of Co-operation, Washington, D. C.

♦ PAUL T. HISER has been appointed assistant professor in the division of industrial arts at the Oswego State Teachers College, Oswego, N. Y. He will also act as supervisor of cadet training, and off-campus teaching.

Association News

THE A.I.A.A. CONVENTION

The Washington, D. C., convention of the American Industrial Arts Association was held at the Shoreham Hotel, May 6, 7, and 8, 1948. The attendance at all of the meetings was very good, especially when one considers that May is more than usually crowded with extra duties for most industrial-arts teachers.

The meetings were started Thursday morning, May 6, with a discussion on teacher education. John A. Whiteset, president, presided. The discussion panel consisted of James J. Hammond, Fitchburg, Mass.; Robert D. Helsby, Oswego, N. Y.; Ivan Hostetler, Collegeboro, Ga.; Lynne Monroe, Santa Barbara, Calif.; Harold G. Palmer, Cedar Falls, Iowa; David L. Readdick, Lakeland, Fla.; Heber A. Sotzin, San Jose, Calif.; R. M. Torgerson, Bowling Green, Ohio; and the subject of discussion was the suggestion made by Dr. Otto A. Hankammer that the association undertake a study and prepare a bulletin on the evaluative criteria and techniques to be used for accreditation purposes.

The afternoon session was presided over by Frank C. Moore, Cleveland, Ohio. The subjects for discussion were "The Modern Elementary

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School," "The Large City Program," and "The Preparation of Teachers."

At 4 p.m. "School Shop Safety" was discussed under the chairmanship of DeWitt Hunt, Stillwater, Okla., and the subject was treated by the various speakers from the viewpoint of industry, the National Safety Council, and from the school angle.

"Safety Designed Equipment" was the title of an address ably presented by Smithy Shultz, Rock Springs, Wyo.

The evening session was devoted to a discussion of state supervision.

G. Wesley Ketcham, Hartford, Conn., emphasized that with 30,000 industrial-arts teachers in the schools, supervision was needed, as was also expert advice on methods, shop layouts, equipment, etc.

John R. Ludington, who has been appointed consultant for industrial arts at the U. S. Office of Education, pointed out that some of the southern states which had been largely agricultural, are now turning industrial. Industrial arts must receive more and more emphasis in these states and it should be well administered. State supervision, therefore, is very necessary, and the one who has charge of this supervision should be more consultant than supervisor.

The Friday morning conference started with a review of the policies and plans of the association, and a report on the projects and publications that had been prepared by the A.I.A.A. during the past year.

At 10 o'clock the subject of implementing the new curriculum was taken up.

Roy A. Radtke, Milwaukee, Wis., presided.

Dr. William E. Warner stated that the objectives under the new curriculum could be grouped under three heads — production, consumption, recreation. Technology exemplifies power, manufacturing, transportation, construction, and communication. He also stated that industrial arts as a term for our subject was on the way out, but that a new term for it had not as yet been found.

Reports were made of progress in applying and adapting the new curriculum by Kenneth W. Brown, Philadelphia, Pa.; William E. Caswell, McDonogh, Md.; Carlton J. Gerbracht, Southampton, N. Y.; Harold G. Gilbert, Oswego, N. Y.; J. Lyman Goldsmith, Los Angeles, Calif.; Walter F. McAndrews, Hartford, Conn.; and F. H. Newton, Jr., Sharon, Pa. R. Lee Hornbake, College Park, Md., then summarized the discussion.

The Friday afternoon session was in charge of Stanley J. Pawelek, Baltimore, Md.

Gerald Baysinger, Detroit, Mich., spoke on teaching aids and devices. He emphasized the necessity of using models, both cutaway and solids, in teaching industrial-arts subjects; and the need of giving the students the experience of handling specimens. He also advocated field trips, movies, slides, etc.

A. F. Gross, Kingsville, Tex., discussed the teaching of photography to adults, and E. A. Hauenstein, Lima, Ohio, presented drawings, diagrams, etc., of many kinds which would help to make the subject interesting to students.

Walter R. Williams, vice-president, presided at The International Fellowship assembly in the evening. At this session, Shriver L. Coover, formerly of Santiago, Chile, gave an interesting account of his sojourn in South America; and Harold K. Anderson, formerly of Stockholm, showed a 900-ft. colored film which recorded his trip to the Scandinavian countries during the previous summer.

Shriver L. Coover gave an interesting account of the growth and development of the Smithsonian Institute, which was founded in 1829 by an Englishman who had never visited America.

At the business meeting held on Saturday morning, the following officers were elected for the coming year:

President, Dr. Walter R. Williams, Jr., University of Florida, Gainesville, Fla.

Vice-president, Dr. DeWitt Hunt, A. & M. College, Stillwater, Okla.

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Plastic Binding Units
Hercules Punch with Slot-Hole Dies in position. Size, 24x13 overall.
Two New Units
No. 20 consists of one Hercules Punch complete with two Tauber Slot-Hole Dies and several thousand Tauber Tubes and Multi-Rings in red, white and blue colors, in a range of several popular sizes. These Tauber Tubes and Multi-Rings are illustrated below.
Tauber Tube is easily inserted and locked by hand. It is available in red, white or blue in several sizes. It remains closed even with hard usage, yet is easily opened for insertion of pages.
Tauber Multi-Ring is a closely wound plastic coil making an attractive binding for any publication. It is available in nine colors, in several sizes. It is quickly and easily inserted.
No. 22 consists of one Hercules Punch complete with two 4" Tauber Twist Dies, an electric sealer, and several hundred 12" Tauber Twists as illustrated on the left edge of this announcement.
Tauber Twist is a continuous plastic coil especially recommended for permanent binding since the ends are sealed. It is available in nine colors and in several sizes.
Tauber Plastic Bindings are simple, inexpensive, attractive, and serviceable. They are especially useful for binding a wide range of school printing projects.
ATF is the exclusive school and institutional dealer for Tauber Binding products. For illustrated literature and detailed information, write to:
American Type Founders
Department of Education
200 Elmora Avenue
Elizabeth B, N. J.
ATF

Executive secretary and treasurer, D. Arthur Bricker, Board of Education, Cincinnati, Ohio.

♦ Three deans of engineering colleges were elected officers of the American Society for Engineering Education at the annual convention at Austin, Tex., this summer: Dean Clement J. Freund of the College of Engineering at the University of Detroit was elected president; Dean Thorndike Saville of the New York University College of Engineering, and Dean F. M. Dawson of the College of Engineering of the State University of Iowa, were named vice-president. James S. Thompson, vice-chairman of the board of the McGraw-Hill Book Company, was elected treasurer.

♦ The Pennsylvania Industrial Arts Teachers Professional Association of Allegheny County held its regular meeting at Har-Brack Union High School and Harrison Township Junior High School on April 21, 1948. The hosts were John Barney, Joseph L. Kennedy, Norman E. Orlushe, and Arthur R. Taggart.

At the business meeting it was decided to cooperate with the Fraternity Epsilon Pi Tau, Psi Chapter of the California State Teachers College in compiling a booklet of teaching material. This booklet is to be made available to every teacher who contributes material.

A committee was selected to proceed with the new membership cards, emblem, and pins, using the original design made by John Barney, chairman of the committee. Arthur R. Taggart and Charles E. Williams are serving on this committee.

The results at the election of officers for 1948–49, who will take office September, 1948, are: president, J. Philip Young; vice-president, Arthur R. Taggart; recording secretary, Harry J. King; and treasurer, Charles E. Williams.

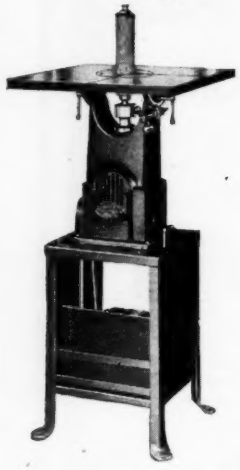
Harry J. King, who is industrial-arts instructor at Mount Oliver High School, invited the members to meet in his shop for the next meeting.

♦ The Trade and Industrial Education Association of the Pittsburgh, Pa., territory held its annual meeting on May 19, 1948.

Reg Ivy, president, was chairman of the meeting. Alexander Booth, principal of the Washington Vocational High School, a past president of the association, gave a short welcoming address.

(Continued on next page)

The Lowest Priced, Practical, Rapid Production
SPINDLE SANDER-GRINDER
BOICE-CRANE
NO. 2006



Not one important feature of high priced machines has been omitted. It sands woods, and grinds plastics, aluminum, masonite, brass, bronze, zinc and sheet metal and does internal and external grinding on contours. Compact, portable and vibrationless.

Handles 1", 1½", 2" and 3" abrasive sleeves for a wide work range.

Sands or grinds up to six-inch thick stock, straight and contours to as sharp a radius as ½", and all bevels 0 to 45°.

Table tilts by sensitive worm and rack fitted with accurate quick reading scale for bevel work. Two scribed index lines show exact positions for beveling, drafting patterns, and for core-box work.

Drum oscillates with a ⅞-inch stroke, 83 times per minute at 2,500 r.p.m.'s, sanding silky smooth with the coarse faster-cutting, longer-lived abrasives, a sure protection against scoring.

Convenient large storage compartment in the floor stand for all accessories and a large supply of abrasive sleeves.

Sealed crankcase keeps out dust and dirt. Rotating parts run in a bath of oil. Oscillating mechanism mounted on precision steel balls for friction-free, vibrationless operation.

SPECIFICATIONS:

Ball bearings at all vital points. Positive lubrication.
Table: Tilts 45° two ways. 20" x 20".
Stroke: 7/8". 83 complete strokes per min. at 2500 r.p.m.
Drums: 9"long — 6" above table. Expanding rubber.
Abrasive Sleeves: 1", 1½", 2", 3" dia.

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- Durably constructed, they can take a beating which would incapacitate most machines.

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Thickness Planers • Tilting Arbor Saws • Spindle Sanders • Spindle Shapers • Band Saws

(Continued from previous page)

Then Irv Hyman, chairman of the research and educational committee, gave a report dealing with the degree equivalent question.

Dr. Fleming, president of the Pennsylvania Vocational Association, commented on the committee report, and spoke on other problems confronting the teachers.

John Wragg discussed the problems encountered in certificating driver training teachers.

The officers elected for the coming year are: president, A. S. Chuska, South Hills High School; first vice-president, Wm. R. Lloyd, Washington Vocational High School; second vice-president, Irv Hyman, Frick School; secretary, Earl Krotzer, Washington Vocational High School; and treasurer, John Wragg, Peabody High School.

♦ At its annual meeting in Tulsa, Okla., the Oklahoma Vocational Association elected the following officers for the year 1948–49: President, Perry McCoy, co-ordinator, distributive education, Enid; vice-president, Miss Carrie Fisher, home-economics instructor, Lawton; vice-president, Harold Hutton, vocational agriculture instructor, Clinton; secretary-treasurer, E. P. Chandler, state supervisor, trade and industrial education.

♦ The new officers elected by the Washington Vocational Association for the year 1948–49, are: president, Lloyd W. Cook, Spokane Trade School, Spokane; secretary-treasurer, Eleanor McCready, 119 West Sixth, Port Angeles; vice-presidents, agriculture — J. Arthur Johnson, Ellensburg High School, Ellensburg; distributive education — Gordon Simmons, Weatherwax High School, Aberdeen; home economics — Miss Lucy McCormick, Spokane Public Schools, Fourth and Stevens, Spokane; trade and industrial — S. G. Cook, Spokane Trade School, Spokane; president ex officio, Dave Hartzog, Puyallup High School, Puyallup.

Questions and Answers

PLANS FOR PLYWOOD BOATS

1123. Q.: Do you have any row boat plans in 14-ft. or 16-ft. plyboard boats? — *L. W. E.*

A.: Articles on boats have appeared in the following issues of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION: May, 1930, 16 by 4-ft. Flat-Bottom Boat, pages 188–190 inclusive, plus 1 supplement; April, 1931, 14 ft. 8-in. Outboard Speedster, pages 142–145; February, 1940, 12 by 4-ft. Utility Skiff (Plywood), pages 70–75 inclusive; April, 1941, One-Man Fishing Skiff (Plywood), pages 173–177 inclusive. — *J. J. M.*

News Notes

♦ A project under consideration in Canton, Ohio, contemplates the construction by apprentices, under supervision of journeymen, of a building trades school at which apprentices in those crafts will receive the related classroom instruction they must have. The proposal was made by a member of the Canton Board of Education and has been endorsed by the Stark Tri-County Construction Council, Inc., representing Canton contractors, and the Stark Tri-County Building Trades Council representing Canton unions.

Committees of the contractors and the unions are working out plans for the building with the Canton board of education. The board of education is to furnish the site and materials while the apprentices are to furnish the labor.

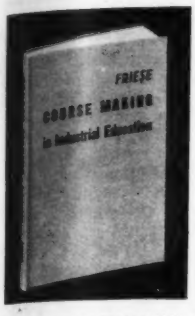
♦ Volume I of the Proceedings of the Forest Products Research Society, a book of 340 pages, 10½ by 7½ in., substantially bound in green cloth with gold lettering, incorporates the papers (with discussion) presented at the first national meeting of the Society held in Chicago on October 31 and November 1, 1947. It also includes monthly bulletins of the Society, May, 1947, to October, 1947, inclusive; Articles of Association and Bylaws; style standards; alphabetical and geographical directories of membership; and other features. The volume is for sale at $6 per copy. Orders should be addressed to Thomas R. C. Wilson, secretary-treasurer, Forest Products Research Society, P.O. Box 2010, University Station, Madison 5, Wis.

♦ Louis M. Roehl, professor of farm mechanics, New York State College of Agriculture, Cornell University, Ithaca, N. Y., celebrates an unusual silver anniversary this month. In May of this year, he marked the twenty-fifth year of continuous publication of his nationally known *The Farmer's Shop Book*.

Originally published in May of 1923, Roehl's *The Farmer's Shop Book* has sold over 55,000 copies. The original printing was for 3,000. The current printing, just announced, runs 9,000 copies.

Since its publication, the book has been revised three times so as to bring the material up to date and to cover new developments. Roehl designed the book to be used as a shopbook in classes of vocational agriculture in high schools. It does, however, fit the needs of the average man who has a farm shop.

Through his books, Roehl has become one of the outstanding farm shop experts in the United States. Other books which he has written include: *Fitting Farm Tools, Tool and Material Identification Charts, Farm Shop Record Book,* and *Shop Management in Rural High Schools.*



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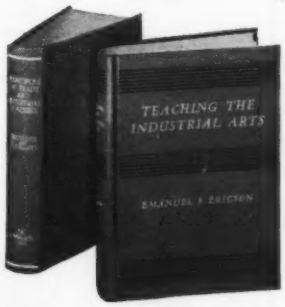

TEACHING the INDUSTRIAL ARTS Ericson

S. How to improve one's own teaching through proved methods of organizing equipment and courses of instruction. Hundreds of teaching details discussed fully from the teachers' point of view. No other book can give more real professional service than this text, regardless of one's teaching experience. $4.00

T. PRINCIPLES OF TRADE AND INDUSTRIAL TEACHING *Selvidge and Fryklund*

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U. ORGANIZING AND TEACHING THE GENERAL SHOP *Newkirk*

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C. INDUSTRIAL ARTS DESIGN *Varnum*
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D. DESIGN IN THE INDUSTRIAL ARTS *Bradley*
Covers problems of art and design in handicrafts, selection of manufactured articles, and approach to representative jobs of designing for production. $3.00

E. INDUSTRIAL-ARTS ELECTRICITY *Lush and Engle*
Planned to provide the right amount of information, presented in the right way for the junior high, and beginning high school student. $2.20

F. SHEET-METAL PATTERN DRAFTING *Daugherty*
114 typical problems, easy to apply to trade conditions. All illustrated with full page detail drawing of the development, step-by-step instructions, photograph of the finished form. Cloth, $3.50; paper, $2.24

G. THE PRACTICE PRINTING *Polk*
The leading book in the field of school printing. Covers the whole practice of printing from job layout to gathering, folding, and covering the finished product. $2.25

H. ELEMENTARY PRINTING JOB SHEETS *Polk* $1.04

I. ELEMENTARY PLATEN PRESSWORK *Polk* 2.00

J. GENERAL SHOP HANDBOOK *Willoughby and Chamberlain* .92

K. PROBLEMS IN BLUEPRINT READING *Castle* .96

L. PROBLEMS IN ARCHITECTURAL DRAWING *Elwood* 3.00

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O. MODERN METALCRAFT *Feirer* 3.50

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(Continued from page 32A)

New Delta collet chuck

8 threads per inch. It has no projections to catch and injure clothing, fingers, or flesh, or damage tools, and work can be done with it from any angle and right up against the chuck without danger. Both the safety and accuracy of the chuck make it ideal for use in schools, pattern shops, and home workshops.

An additional feature of the new Delta collet chuck is that it can be tightened or loosened with a twist of the wrist, thus eliminating the use of a wrench. Closing smoothly and evenly over the entire circumference, with all pressure at right angles to the center of the work, the chuck will not mar any job. The chuck locks securely to both spindle and work. It is fully balanced for high-speed work, and there is no longitudinal play.

This Delta chuck has an over-all length of 2½ in. with an outside circumference of 2¾ in. Work capacity of the chuck ranges from ½ up to 2 in. Three double-end collets are ½ and ⅝ in., ¾ and 1 in., and 1¼ and 1½ in. The chuck weighs but 2½ lb.

For brief reference use IAVE—0904.

THE NEW TURNER BLOWTORCH

The new Turner 92-A blowtorch has been designed to give a pencil-point flame for greater precision in sweating solder-type fittings. It is meeting a practical need in the present-day trend toward extensive use of copper tubing in electrical, plumbing, heating, and refrigeration work, as well as in numerous specialized industrial applications.

New Turner blowtorch

The new blowtorch provides a flame within a flame, registering 2300 deg. F. by pyrometer reading. Dual valves permit selective flame control, and quicker, more accurate regulation. Idling flame keeps the 92-A torch fully generated for instant use. Objectional noise of the single burner torch is eliminated.

The 92-A has a one-quart capacity seamless brass high polished tank. It is bottom filled. Catalog information on the 92-A is available on request from the Turner Brass Works, Sycamore, Ill.

For brief reference use IAVE—0905.

NEW TRANSPARENT-HANDLED CHISELS

A new line of socket chisels with hard-wear handles of transparent green Tenite have been put on the market recently by Greenlee Tool Co., Division of Greenlee Bros. & Co., Rockford, Ill. They are made in socket butt, socket firmer, and short socket firmer types.

Transparent-handled chisel

Major feature of the chisels is the new modern-styled transparent hard-wear handle, which the company reports as unusually tough so that it withstands severe hammering and pounding. These new handles also are weather resistant and are tested for safety so there is no chance of flash fire or flaming. The new Greenlee handle also features a hardened steel pin, which is inserted through the tenon section and part of the handle body for extra strength and ruggedness.

(Continued on next page)

See what we did this summer!

BRAND NEW CRAFT BOOKS

PLASTIC ARTS CRAFTS — *Adams*
METAL ART CRAFTS — *Miller*
BASKETRY AND RELATED ARTS — *Lee*
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These are wonderful books — utterly practical, fascinating to read whether or not you are about to produce a masterpiece, and really simple as far as directions go. At the same time, information is sound and complete in every phase of the craft. Illustrations are fine, but the extraordinary teaching job overshadows all other excellences. Of course you already know about the earlier books in this series — *Jewelry Making*, *Woodworking*, and *Leathercraft*. All are $2.20 each.

SWOOPE'S LESSONS IN PRACTICAL ELECTRICITY

Revised by HAUSMANN

This is the new 18th Edition — entirely reset and absolutely up to the minute. The book has been rearranged and the resulting new approach increases interest in electrical theory. There are over a thousand experiments, questions and problems. This standard text is known far and wide for clear presentation of fundamentals of electricity, and ease of teaching. The new edition has 769 pages; list price, $4.80.

May we send you any of these new books for 30-day examination?

Van Nostrand
250 FOURTH AVENUE, NEW YORK 3

(Continued from previous page)

Blades for these new Greenlee chisels are bevel edged and are of selected high-carbon steel for a tough, fine-cutting edge. Complete details are available by writing to the firm.

For brief reference use IAVE—0906.

NEW YANKEE ANGLE VISES

To the well-known line of Yankee drill press vises, North Bros. Mfg. Co., Division of Stanley Tools, Lehigh Ave., and American St., Philadelphia 33, Pa., announces the addition of two sizes of angle vises, each available with or without swivel base. Yankee angle vises can be used on the bench or on the machine. They are ground on both sides, front end, and bottom for use on a drill press, milling machine, etc. They are easily converted to low-cost jigs.

Yankee angle vise

The new Yankee angle vises are strong and serviceable, and the method of angle adjustment in Yankee vises permits use of full capacity of jaw opening. Jaws have hardened steel faceplates for long wear. Swivel base is immediately and securely locked in any position by a simple movement of lever, and vise can be quickly detached by loosening one setscrew, without disturbing the work.

A 90-deg. scale is stamped on the vise for setting at proper angle for work. Each vise is equipped with a ground *V* Block for holding round stock firmly.

Folder illustrating Yankee angle vises will be sent upon request.

For brief reference use IAVE—0907.

THE NEW DI-ACRO PUNCH

The new Di-Acro Punch is a double purpose machine which can be used for perforating holes of various shapes and sizes as large as 4 in. in diameter and which also can serve as a precision punch press for blanking, drawing, embossing, and forming operations.

New Di-Acro punch

The powerful action of this precision machine is obtained through a roller bearing cam which converts a small amount of operator effort into a tremendous pressure at the point of impact.

An unusual feature of the Di-Acro punch is its triangular shaped ram which is hardened and precision ground for extreme accuracy. Since turning or twisting of this triangular ram is impossible, the position of the punch head is positively controlled assuring perfect alignment at all times.

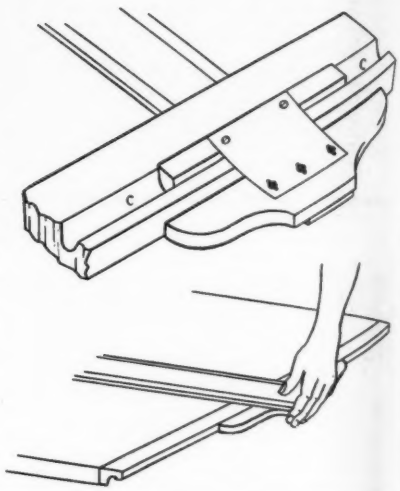
The flexible gauging arrangement built into the DiAcro punch can be quickly adjusted to provide precision location of the material. A wide variety of readily interchangeable punches in round, square, oval, and rectangular shapes are available for this machine thereby making it ideal for both experimental work and production operations.

For further information address O'Neil-Irwin Mfg. Co., 351 Eighth Ave., Lake City, Minn.

For brief reference use IAVE—0908.

A NEW DRAFTING-BOARD ACCESSORY

Glaspell Engineering and Sales Co., 39 So. Raymond Ave., Pasadena, Calif., have developed an accessory, called a Paralledge, which quickly equips drawing boards 16 by 21 in. to 36 by 48 in., with a device that keeps the T square always parallel, prevents it from slipping or sliding around on the drawing board, trues the edge of any drawing board that is out of alignment, and requires no strings, wires, or pulleys. It can be quickly attached to the present drawing board and T square, and consists of a molding which is attached to the drawing board, a short guide bar, and a thin spring plate, assembled as shown in the illustration.



The Paralledge

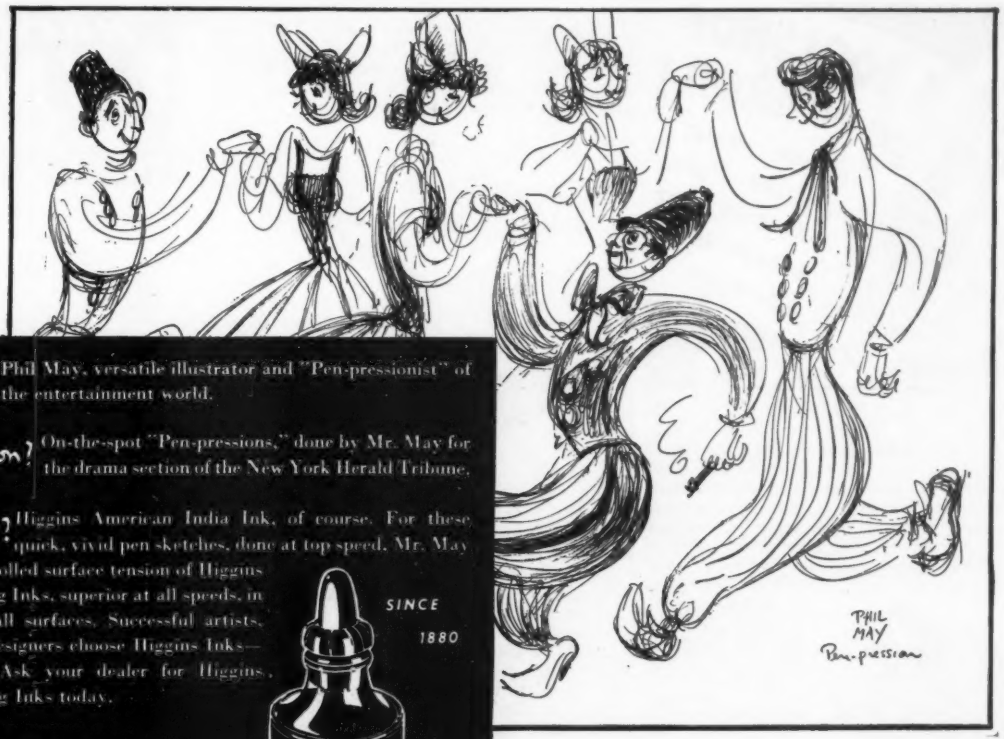
The T square may be removed quickly from the board, and as quickly replaced. The Paralledge makes a unit of board and T square so that both can easily be picked up and carried with one hand.

For brief reference use IAVE—0909.

A NEW HEAVY DUTY STONE DRESSING STAND

The Black & Decker Mfg. Co., Towson, Md., has announced a new addition to their well-known "Vibro-Centric" line of valve reconditioning equipment. This new heavy duty stone dressing stand is very accurate, and is designed for speed and accuracy.

(Continued on page 42A)



The Artist? Phil May, versatile illustrator and "Pen-pressionist" of the entertainment world.

The Illustration? On-the-spot "Pen-pressions," done by Mr. May for the drama section of the New York Herald Tribune.

The Medium? Higgins American India Ink, of course. For these quick, vivid pen sketches, done at top speed, Mr. May relies on the controlled surface tension of Higgins American Drawing Inks, superior at all speeds, in all climates, on all surfaces. Successful artists, illustrators and designers choose Higgins Inks—overwhelmingly. Ask your dealer for Higgins American Drawing Inks today.

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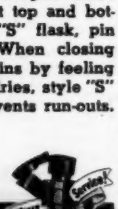
Write for new Catalog No. 59, describing the complete line of Sterling Foundry Equipment.



Sterling FOUNDRY FLASKS

STERLING WHEELBARROW COMPANY - MILWAUKEE 14, WIS., U. S. A.

(Continued from page 40A)

It is made of heavy iron castings held to extremely close tolerances. There is no chance of distortion in the dressing operation. All bearings are completely sealed from abrasive dust which could cause rapid wear and errors.

Heavy duty stone dressing stand

A completely calibrated quadrant with all popular angles boldly marked is read from the top for easy visibility. Quick-acting screw-lock clamps are readily adjusted by hand — wrenches, screw drivers, or gadgets are no longer required — to all combinations of stones up to 6 in. and angles from 0 to 90 deg.

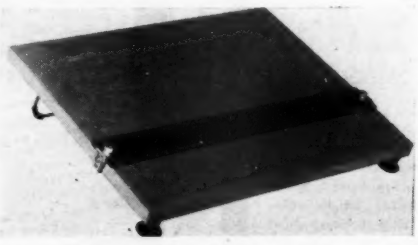
The new heavy duty stone dressing stand can be bolted to any bench or the work top of the Black & Decker valve shop cabinet. Standard equipment includes an adjustable arm with diamond point and screw-feed nib, mounted on Timken tapered roller bearings, and an adjustable mandrel.

For brief reference use IAVE—0910.

NEW E-Z GRIP PARALLEL RULING STRAIGHTEDGE

A new E-Z grip parallel ruling straightedge is now ready for distribution by the Engineering Mfg. Co., Sheboygan, Wis.

The feature of the E-Z grip parallel ruling straightedge is the extra heavy cap covering the cable. The 5/16-in. thickness permits an E-Z grip which facilitates moving of the straightedge up and down on the board or in lifting the straightedge off the board. The angle of bevel has been set in such a manner that a comfortable grip can be obtained. There are no sharp corners or sharp contours on either side. It is a unit in which practicability and comfort have been incorporated.



New E-Z Grip straightedge

Both blade and cap of the straightedge are made from attractive and serviceable black laminated plastic. Clear edges which retain their transparency permanently are set into the edges of the blade. Construction of the entire unit is such to insure dimensional stability throughout the useful life of the straightedge.

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(Continued on page 44A)

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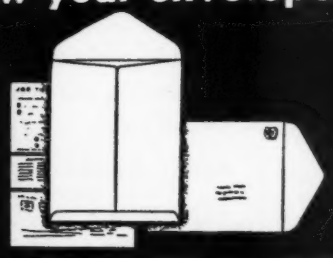

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(Continued from page 42A)

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For brief reference use IAVE—0911.

DRAFTING TESTS AND AIDS

Frank W. Walsh, Box 432, Oshkosh, Wis., has published a number of slides, tests, visual aids, and perspective aids that will be found very helpful by instructors of drawing.

The explanation of the principles of orthographic drawing as well as the tests are all on film strips so that the teacher can easily project them on a screen so that little time is wasted for preparing for a lesson or a test.

Skeletons for perspective drawings also can be obtained in the form of sheets that can be placed on a drawing board with tracing paper over it as an aid for laying out true perspective drawings. Or the skeleton can be projected on the drawing board from a film strip so that the instructor will have no difficulty in making good perspective sketches for explaining his ideas to the students.

These skeletons have been made for making furniture drawings, architectural perspectives, interiors, and bird's-eye perspectives.

Manuals as aids to the instructor also are available.

For brief reference use IAVE—0912.

NEW BLACKHAWK WRENCH CATALOG

Blackhawk has released a new wrench catalog which presents an enlarged number of items. The 36-page catalog, No. 247, pictures 16 new assortments and contains 134 more wrenches than have been listed since 1943.

Many of the added numbers are new to the industry. However, a portion are reinstatements of prewar wrenches.

The reinstatements principally include the complete series of "Nugget" socket wrenches, which have a 7/16-in. drive of *Hexite* alloy steel. This steel was restricted from use by the war, but is now again available. The use of *Hexite* alloy permits the 7/16-in. drive to have the strength of conventional ½-in. drive series with the practical compactness of the ⅜-in. drive.

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The new wrench catalog, No. 247, can be had by writing Blackhawk Mfg. Co., Milwaukee 1, Wis.

For brief reference use IAVE—0913.

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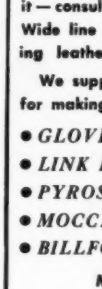
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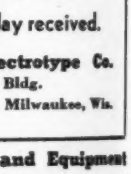
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